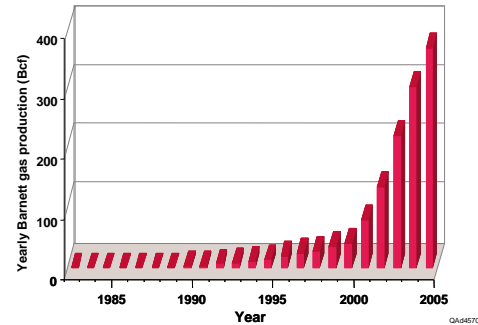


A story of growth and gas: Groundwater use and its effects on water levels in North-Central Texas



groundwater resources
division



Robert E. Mace, Ph.D., P.G.
Texas Water Development Board

*presented to the Texas Groundwater
Protection Committee*

February 15, 2007



The Team

Our contractors:

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- James Bené, P.G.
- Bob Harden, P.E.

Bureau of Economic Geology

- Jean-Philippe Nicot, P.E., P.G.
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Assistance from:

Barnett Shale Water Conservation and Management Committee

- Thomas D. Hayes, Ph.D.
- L. Peter Galusky, Jr., P.E.

Railroad Commission of Texas

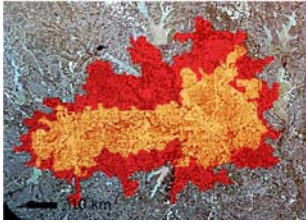
- Leslie Savage

Texas Commission on Environmental Quality

- Kelly W. Mills, P.G.

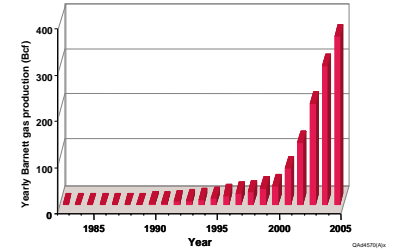
Texas Water Development Board staff

- Ali Chowdhury, Ph.D., P.G.
- Cindy Ridgeway, P.G.
- Robert E. Mace, Ph.D., P.G.

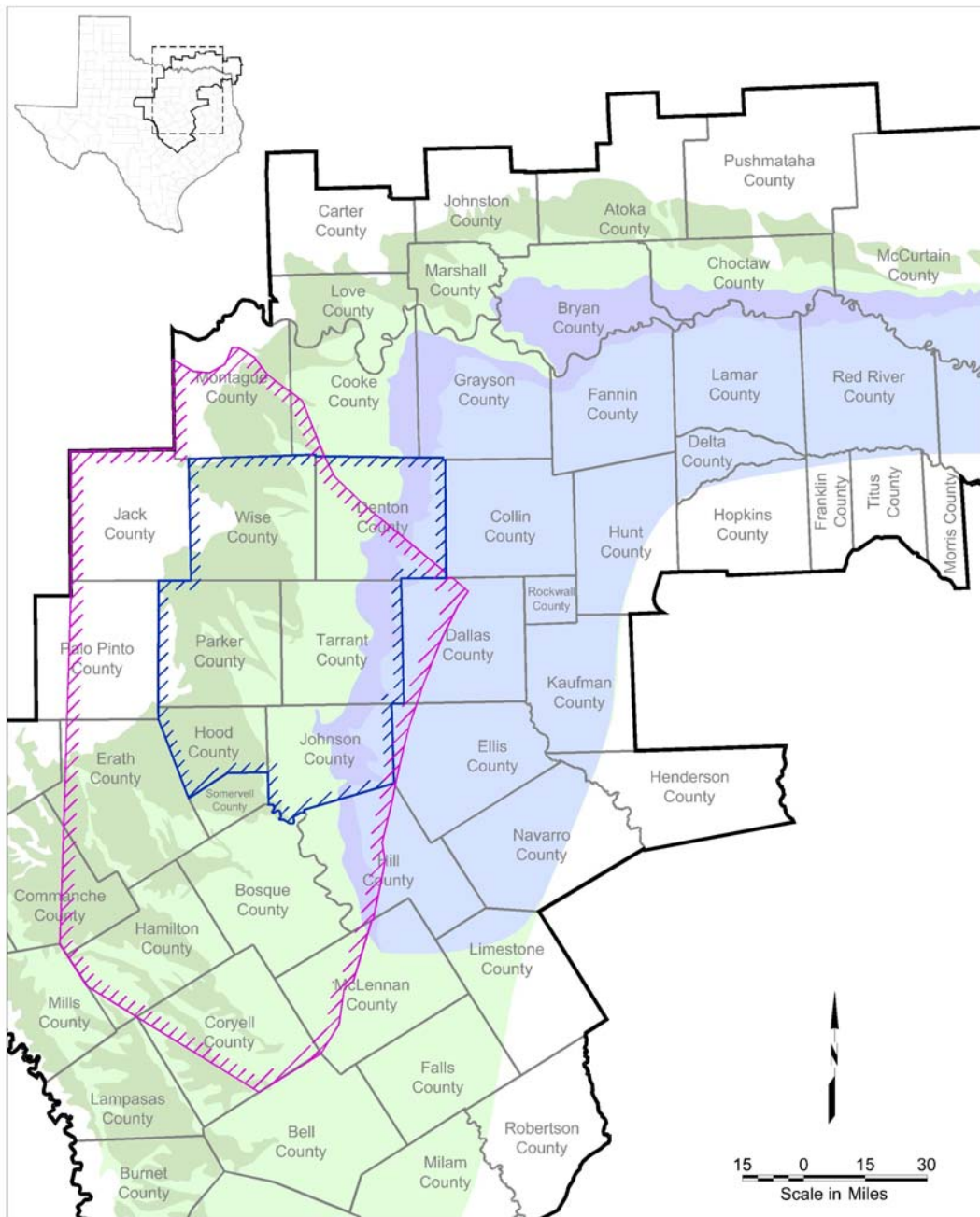


Outline of talk

- Hydrogeology and history
- Urbanization
- Barnett Shale
- The aquifer in the future...
- Conclusions



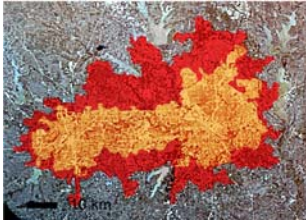
Study Area



/// Bamet Shale use area
/// Updated rural domestic and municipal use area

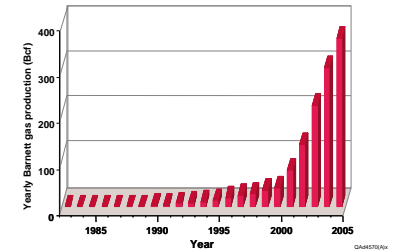
Trinity aquifer
Outcrop
Subsurface

Woodbine aquifer
Outcrop
Subsurface



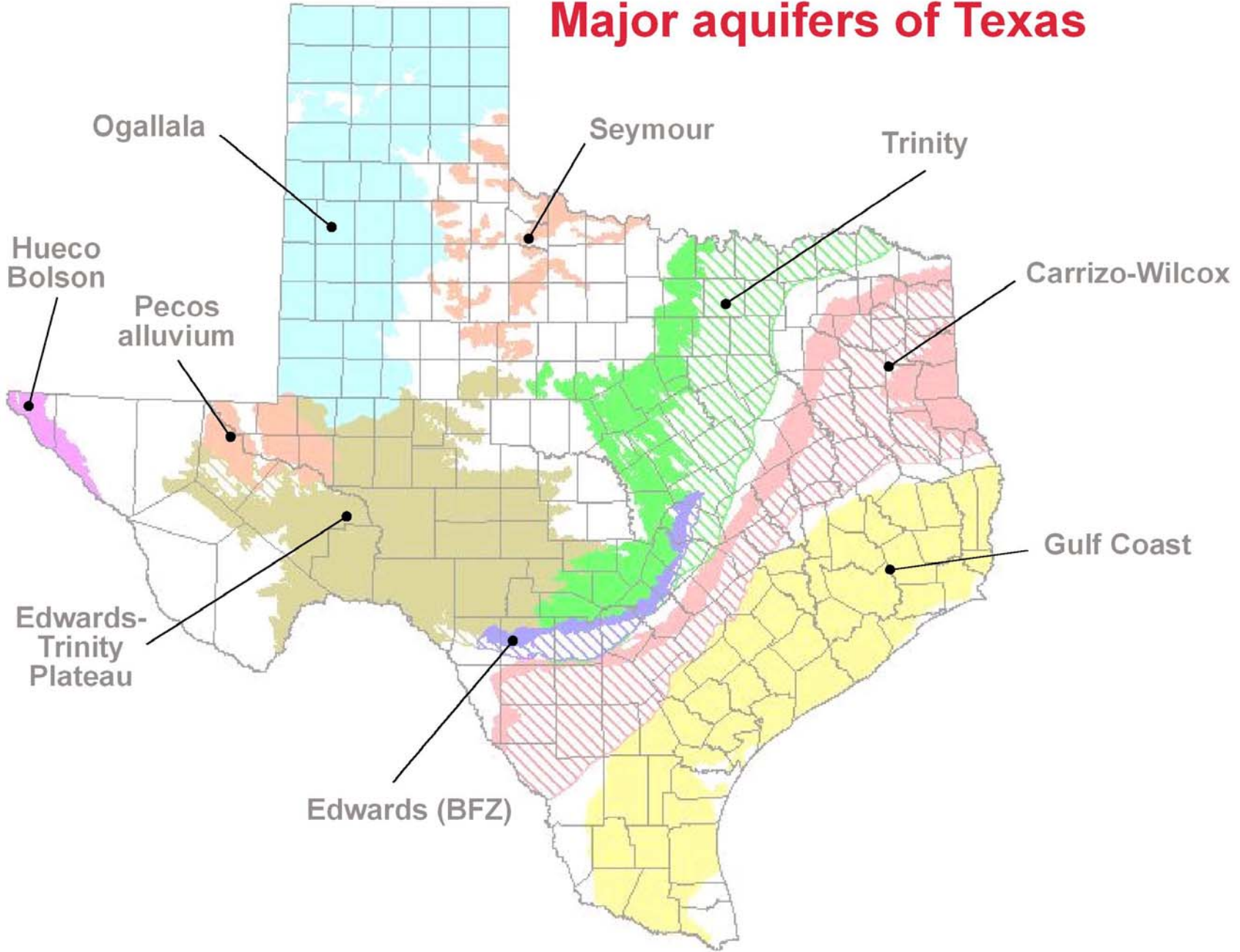
Outline of talk

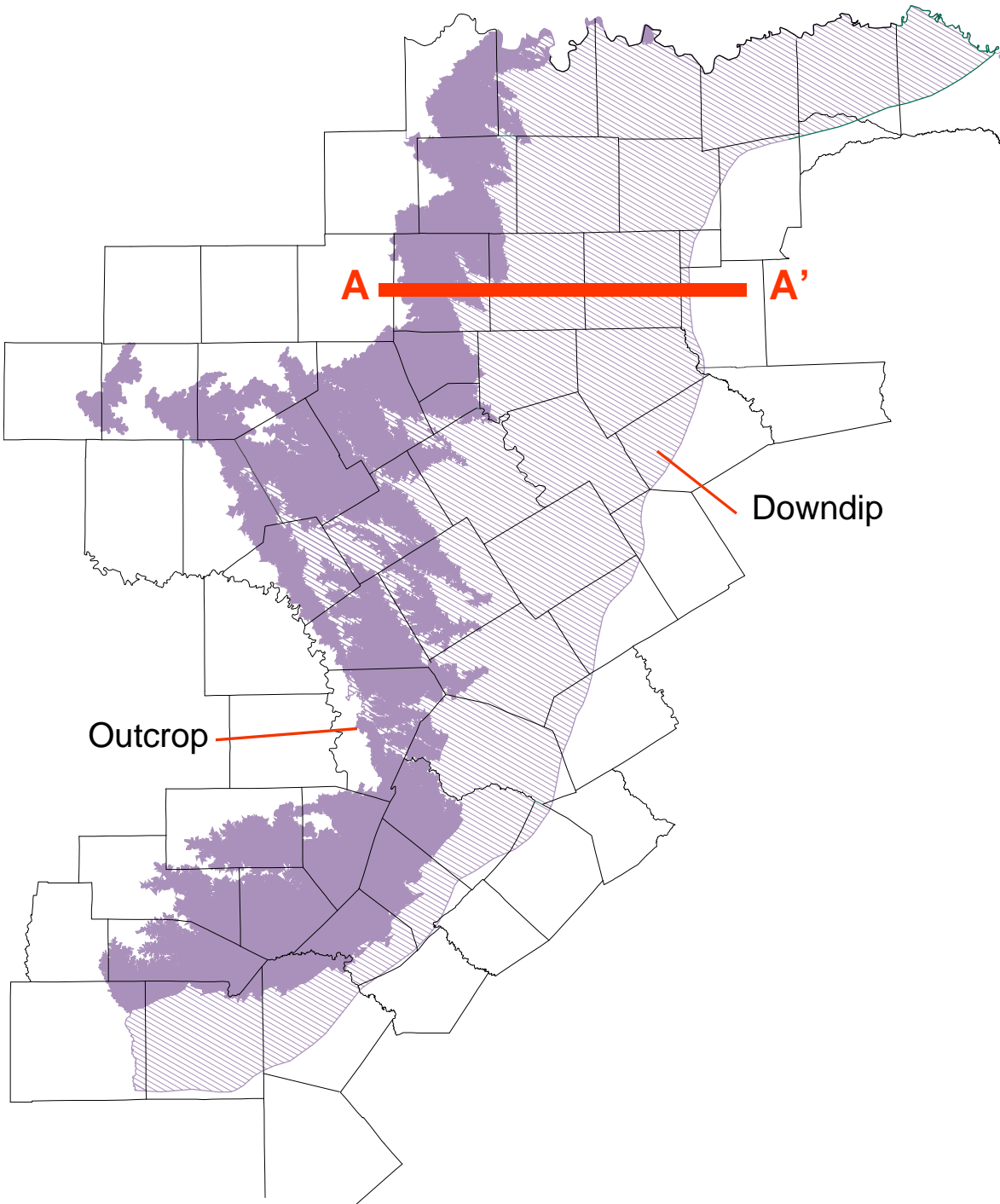
- Hydrology and history
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Major aquifers of Texas





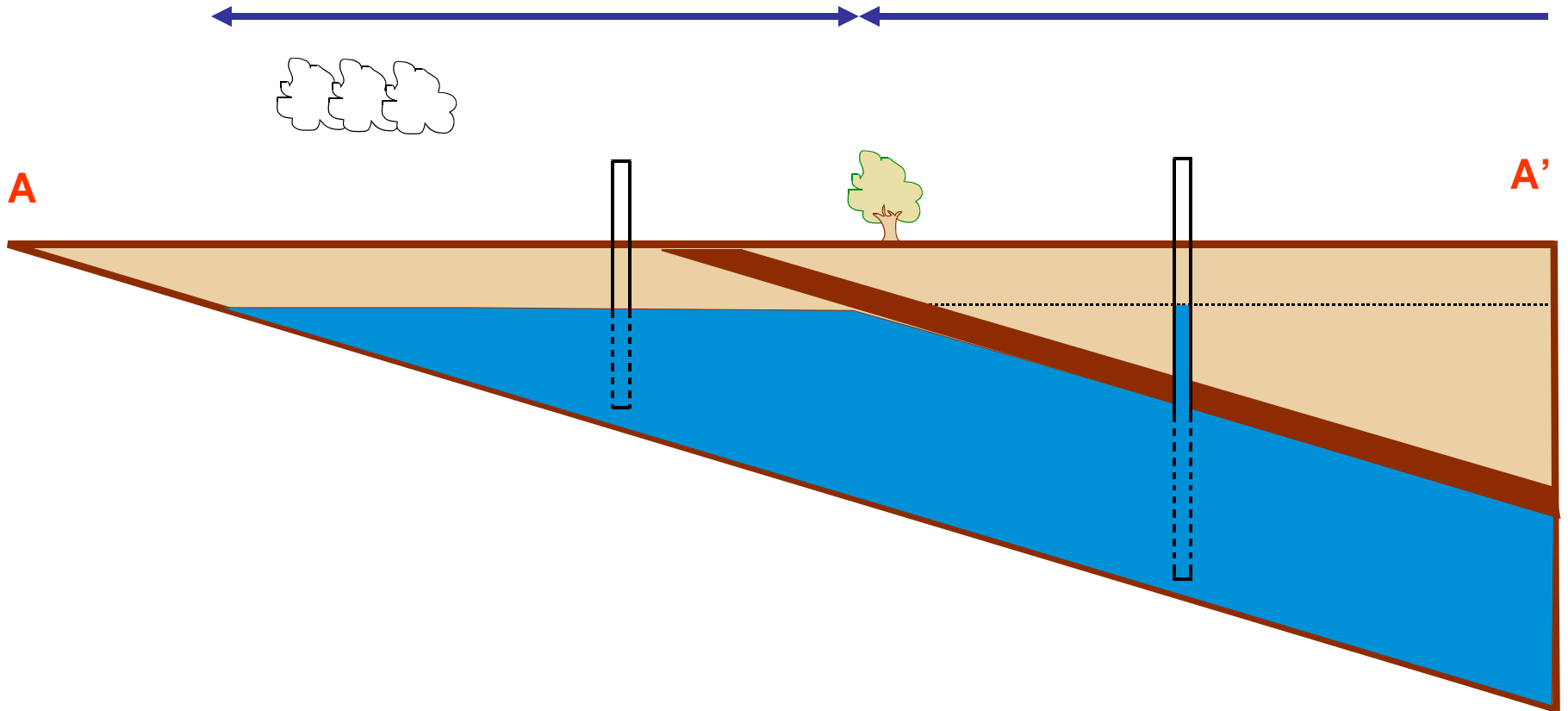
Trinity aquifer



one aquifer: two hydrologic settings

unconfined

confined

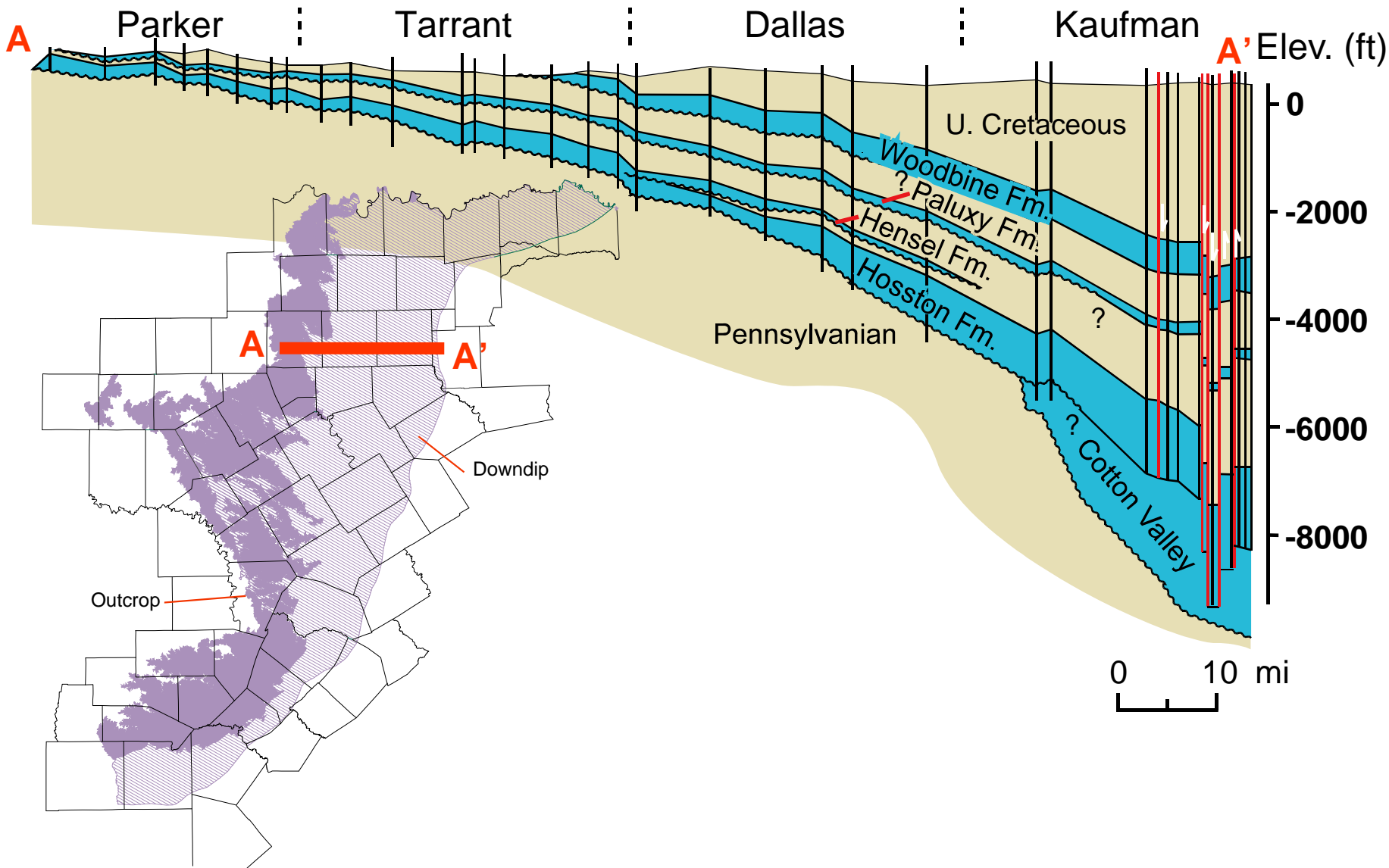


STRUCTURE CROSS SECTION

Cretaceous Siliciclastic Aquifers

West

East



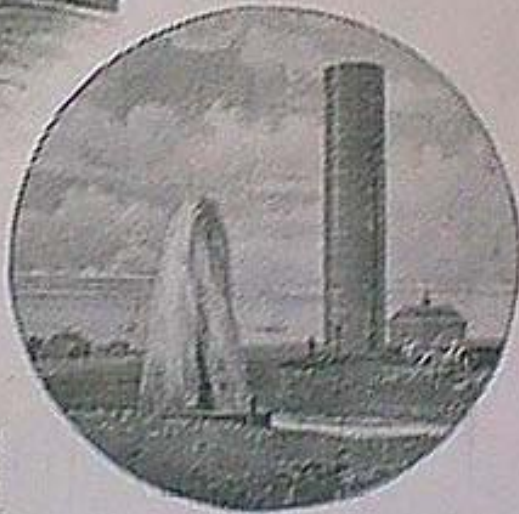
**'Artesian' zones of
Texas circa 1900**



FIG. 44.—Map showing artesian districts of Texas.

1, Coast Prairie system; 2, Hallettsville system; 3, Carrizo system; 4, Black and Grand prairies system; 5, Trans-Pecos Basin system; 6, Stevens County and Jack County systems.

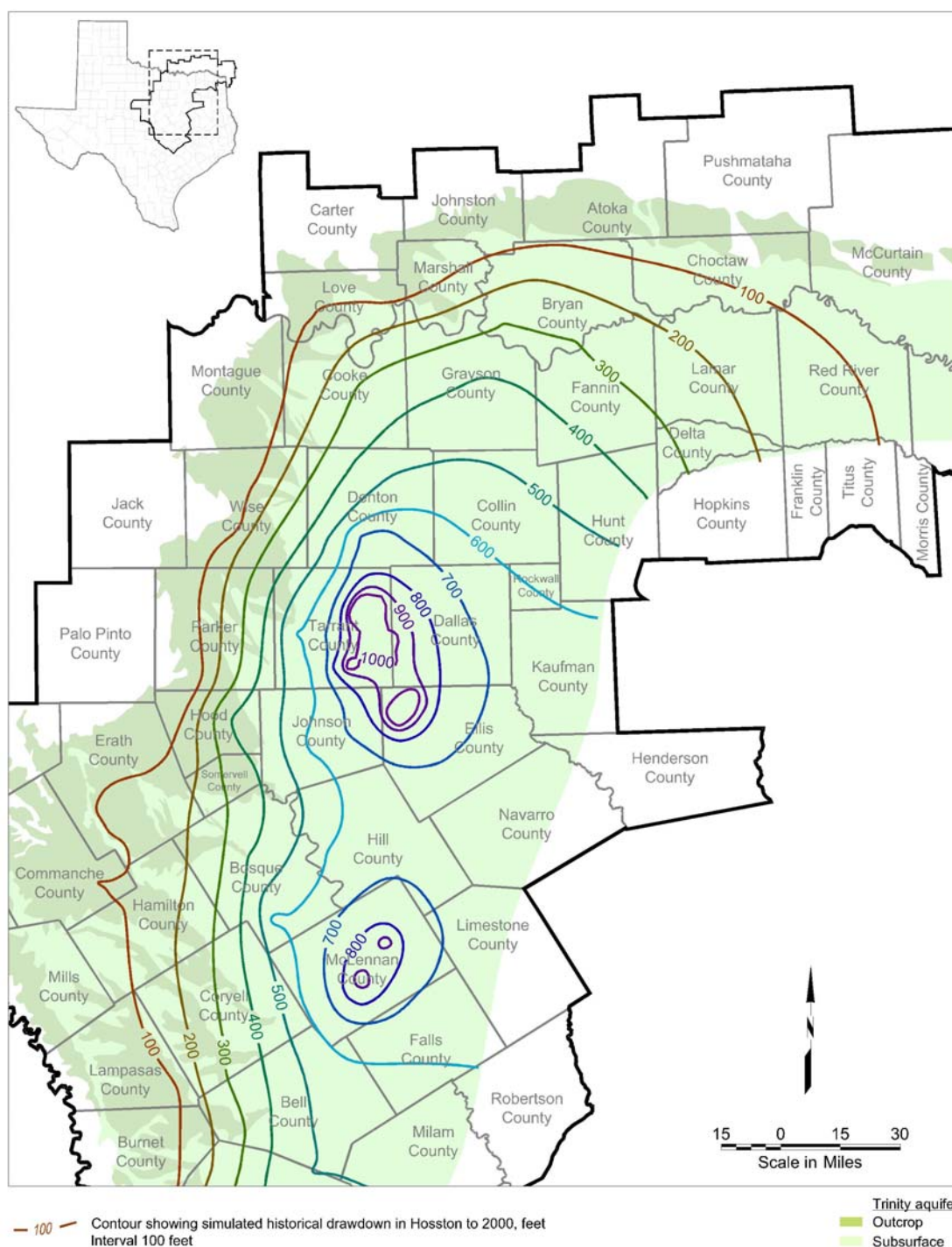
(from R.T. Hill, 1901)



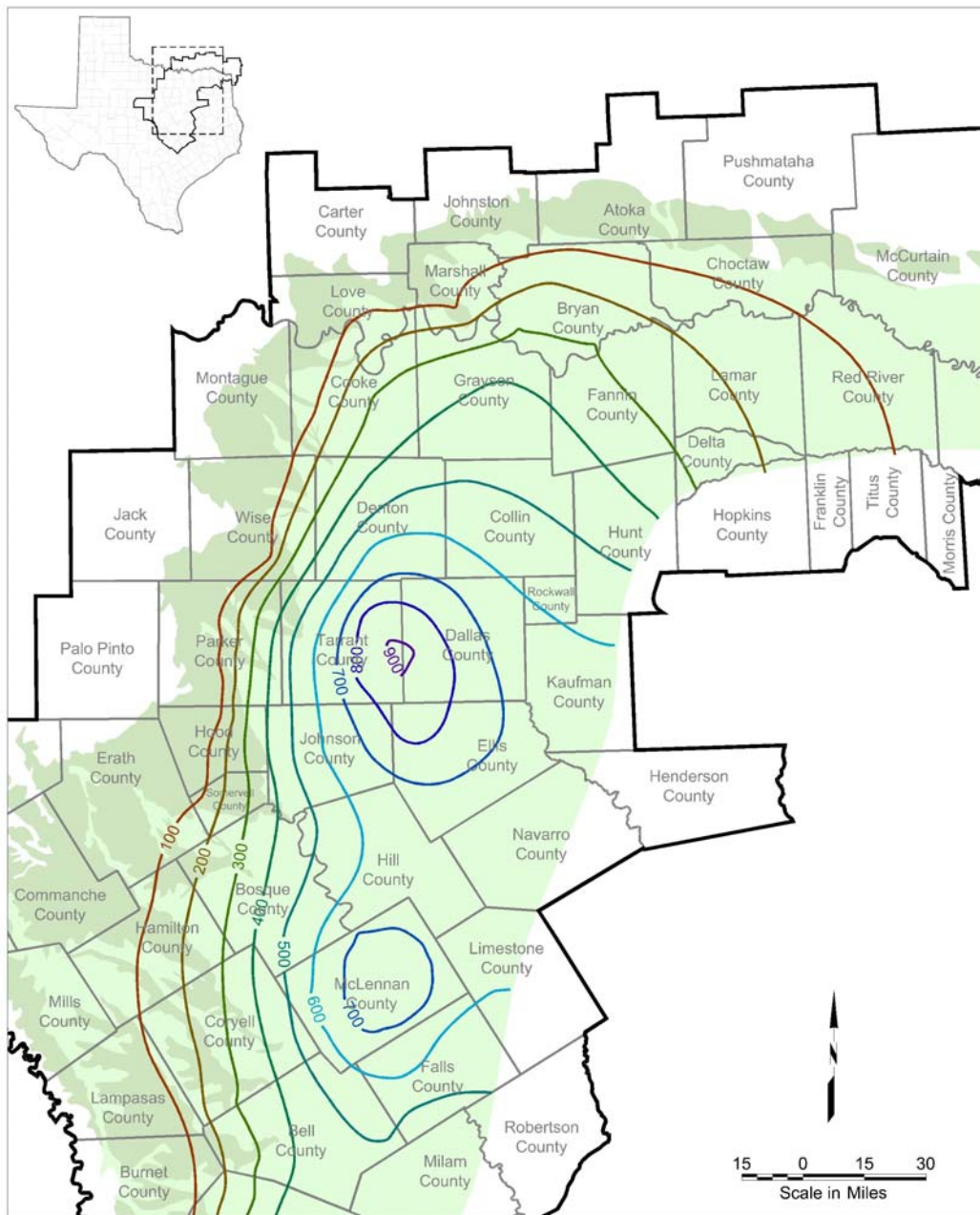
A PAWNEE VILLAGE, A VIEW OF THE GREAT PLAINS, A VIEW OF THE MOUNTAIN RANGE AND GEYSERS NEAR TO THE GREAT PLAINS, A VIEW OF THE MOUNTAIN RANGE AND GEYSERS NEAR TO THE GREAT PLAINS, A VIEW OF THE MOUNTAIN RANGE AND GEYSERS NEAR TO THE GREAT PLAINS.

Waco: City of Geysers

Historic water level declines to 2000 Hosston



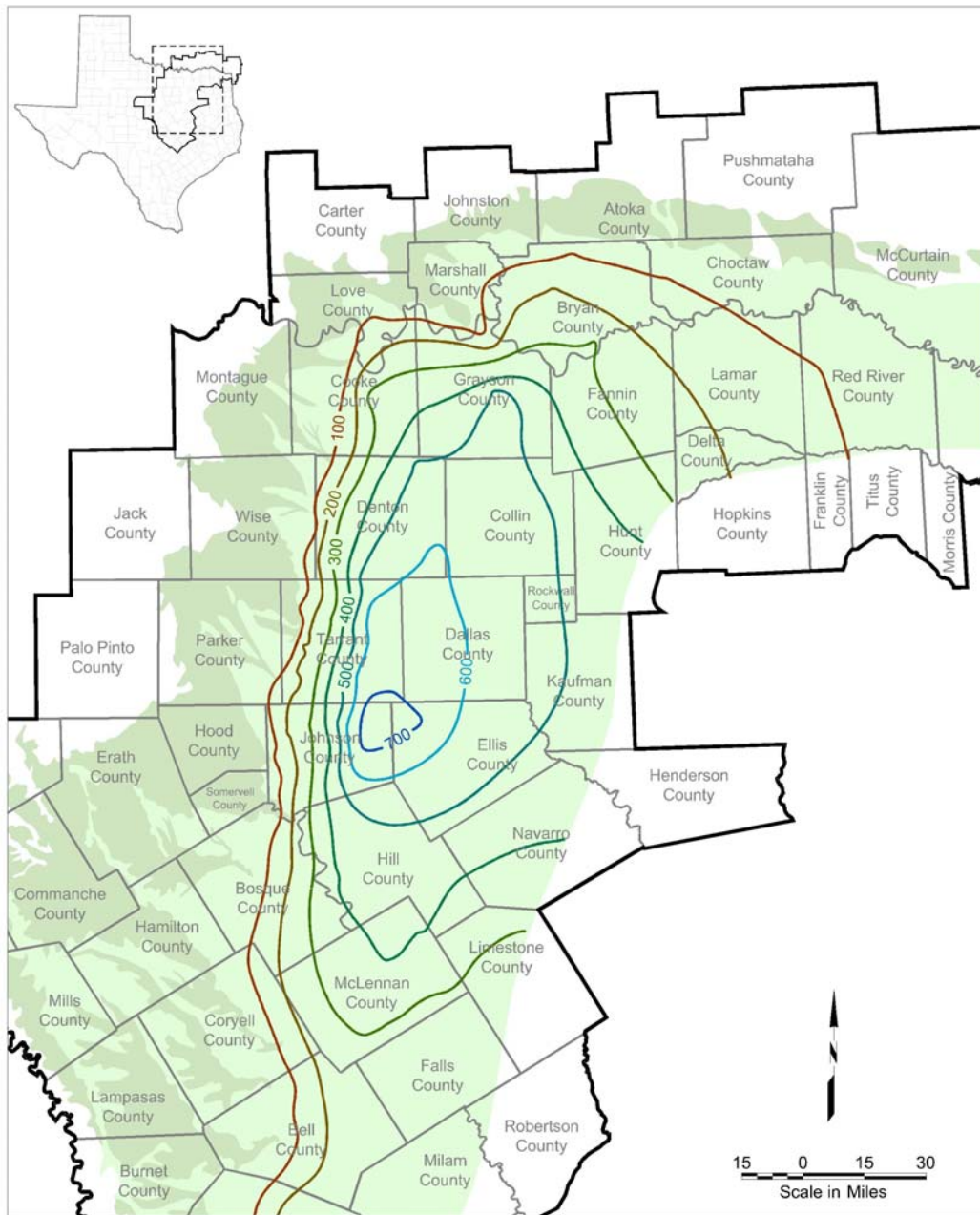
Historic water level declines to 2000 Hensell



— 100 — Contour showing simulated historical drawdown in Hensell to 2000, feet
Interval 100 feet

Trinity aquifer
Outcrop
Subsurface

Historic water level declines to 2000 Paluxy

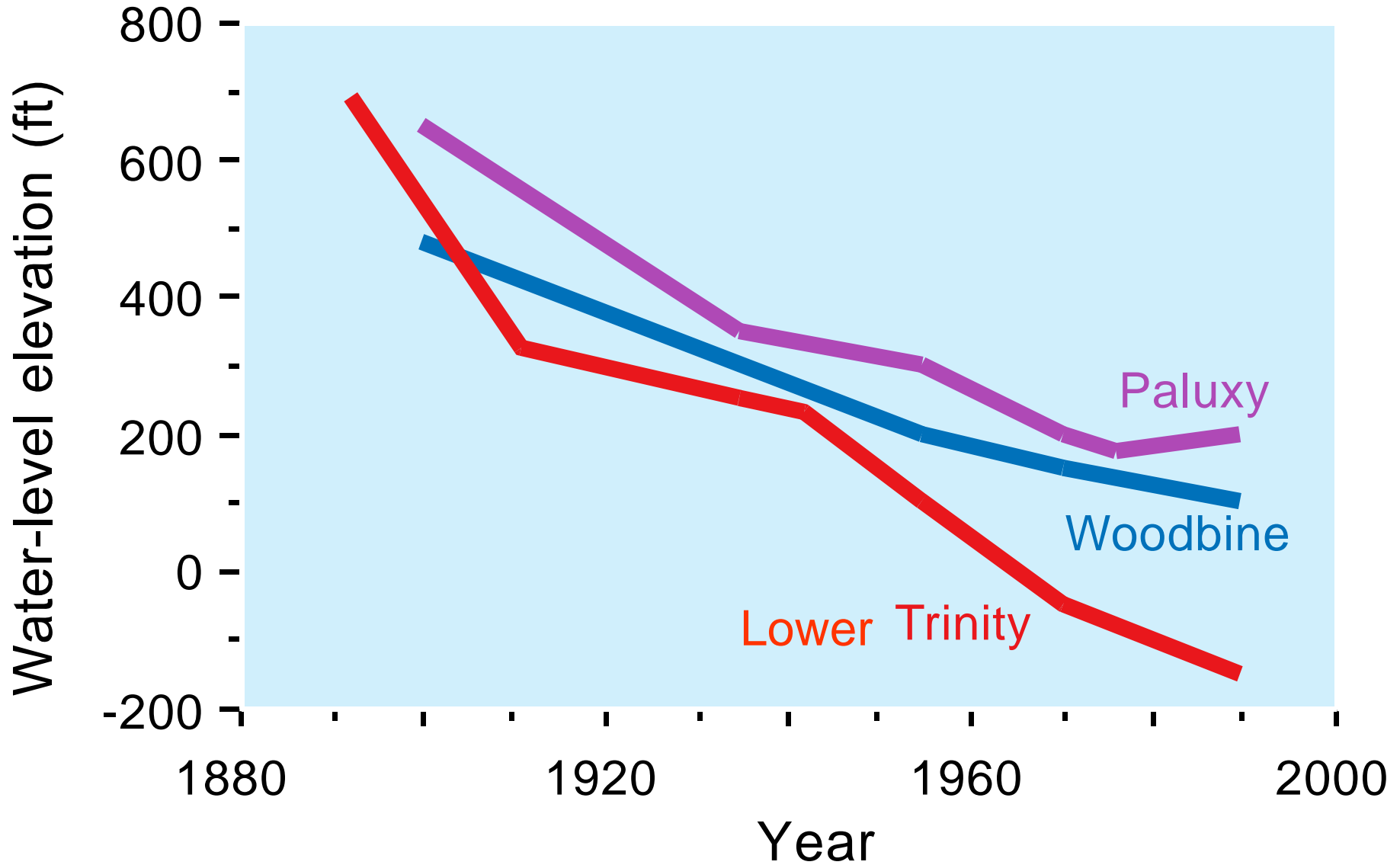


— 100 — Contour showing simulated historical drawdown in Paluxy to 2000, feet
Interval 100 feet

Trinity aquifer
Outcrop
Subsurface

15 0 15 30
Scale in Miles

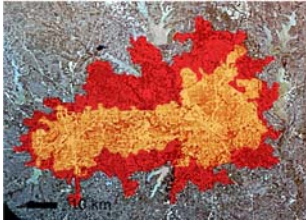
Water level declines





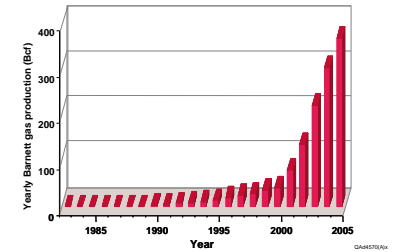
Some water facts for study area:

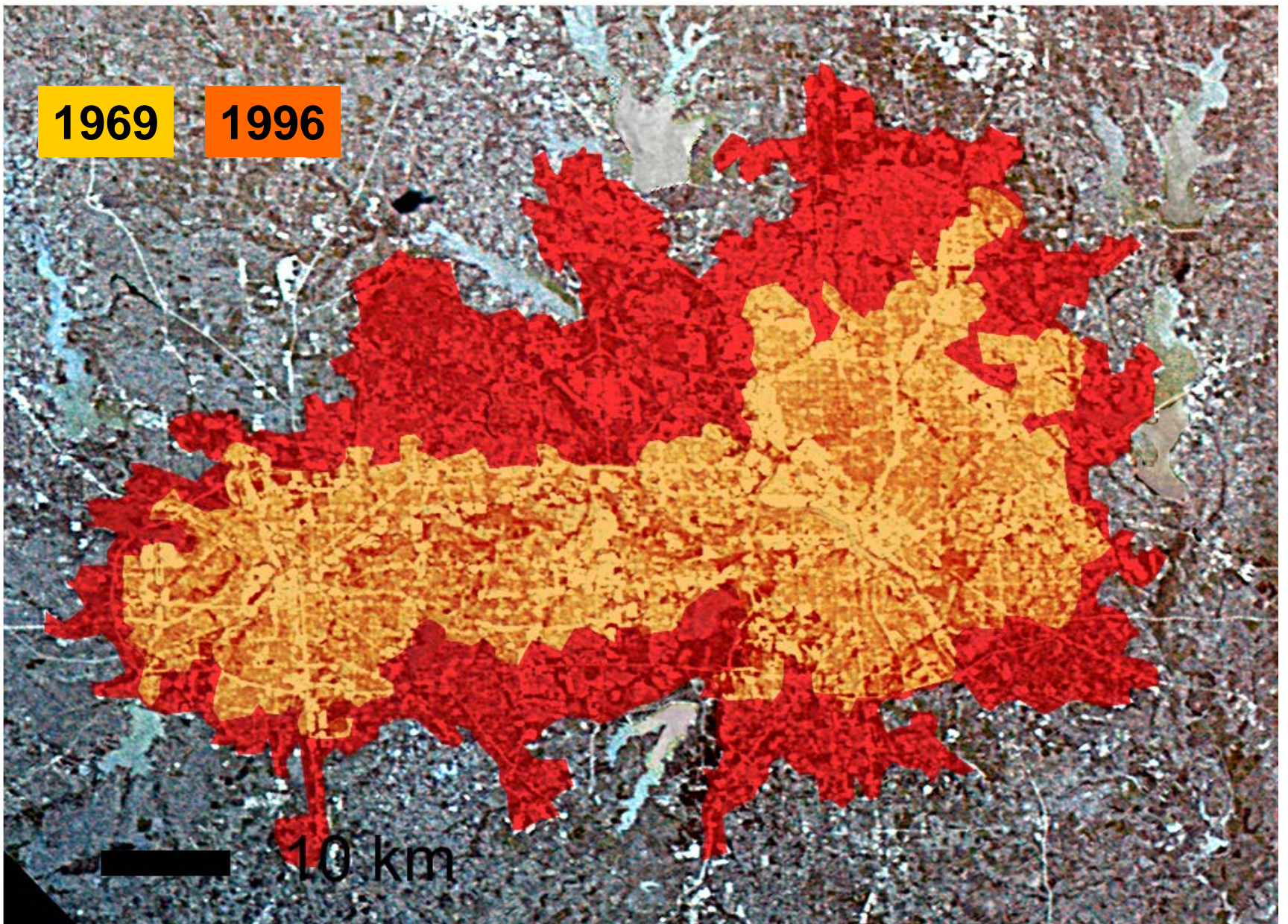
- About 1.3 million acre-feet of water used in 2000
- 77% of this water was for municipal use
- 89% of this water was from surface water
- 11% of this water was from groundwater
 - 1% from groundwater for Dallas County
 - 85% from groundwater for Cooke County
- Expect to need 2.1 million acre-feet in 2025



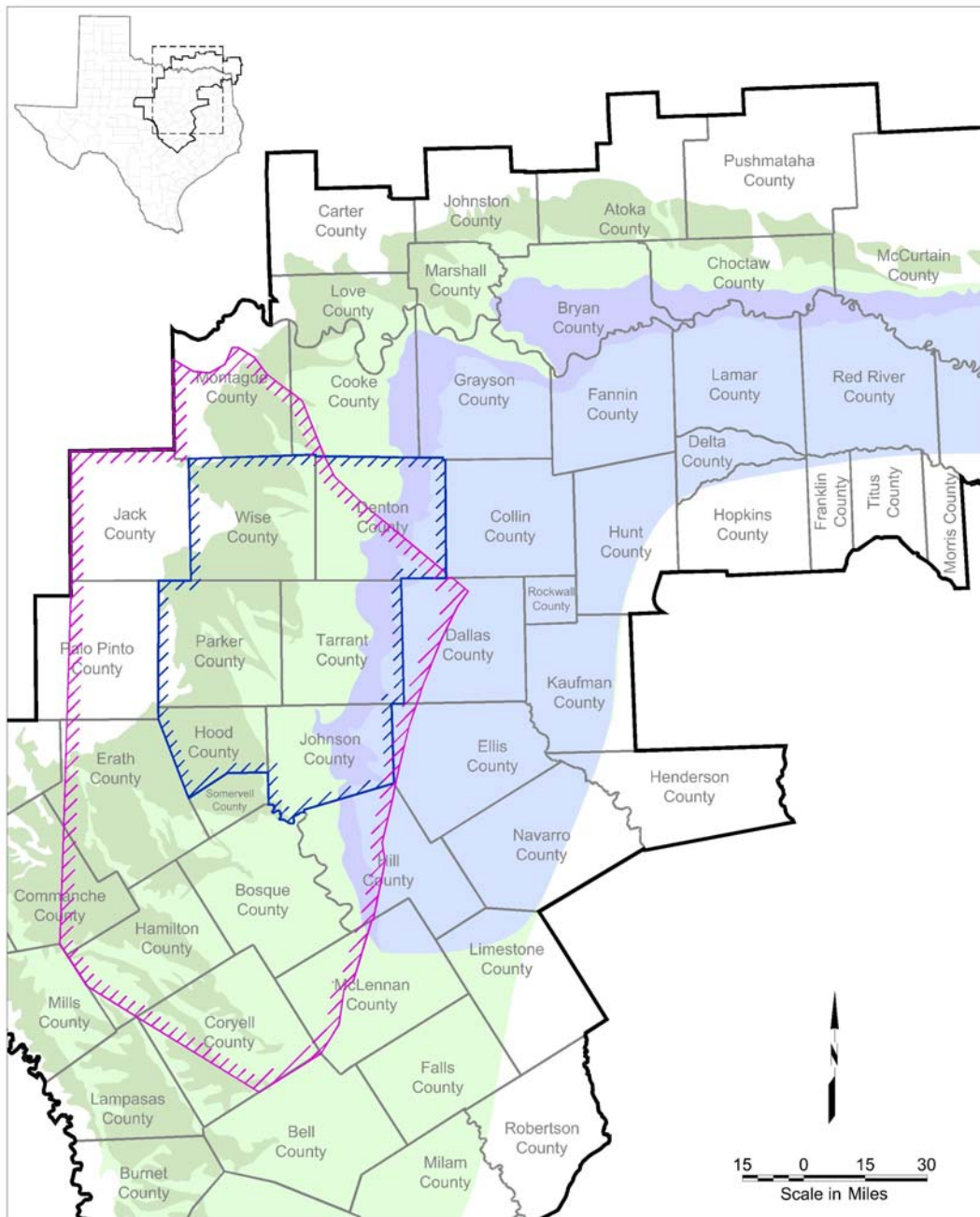
Outline of talk

- Hydrology and history
- **Urbanization**
- Barnett Shale
- The aquifer in the future...
- Conclusions





Study Area

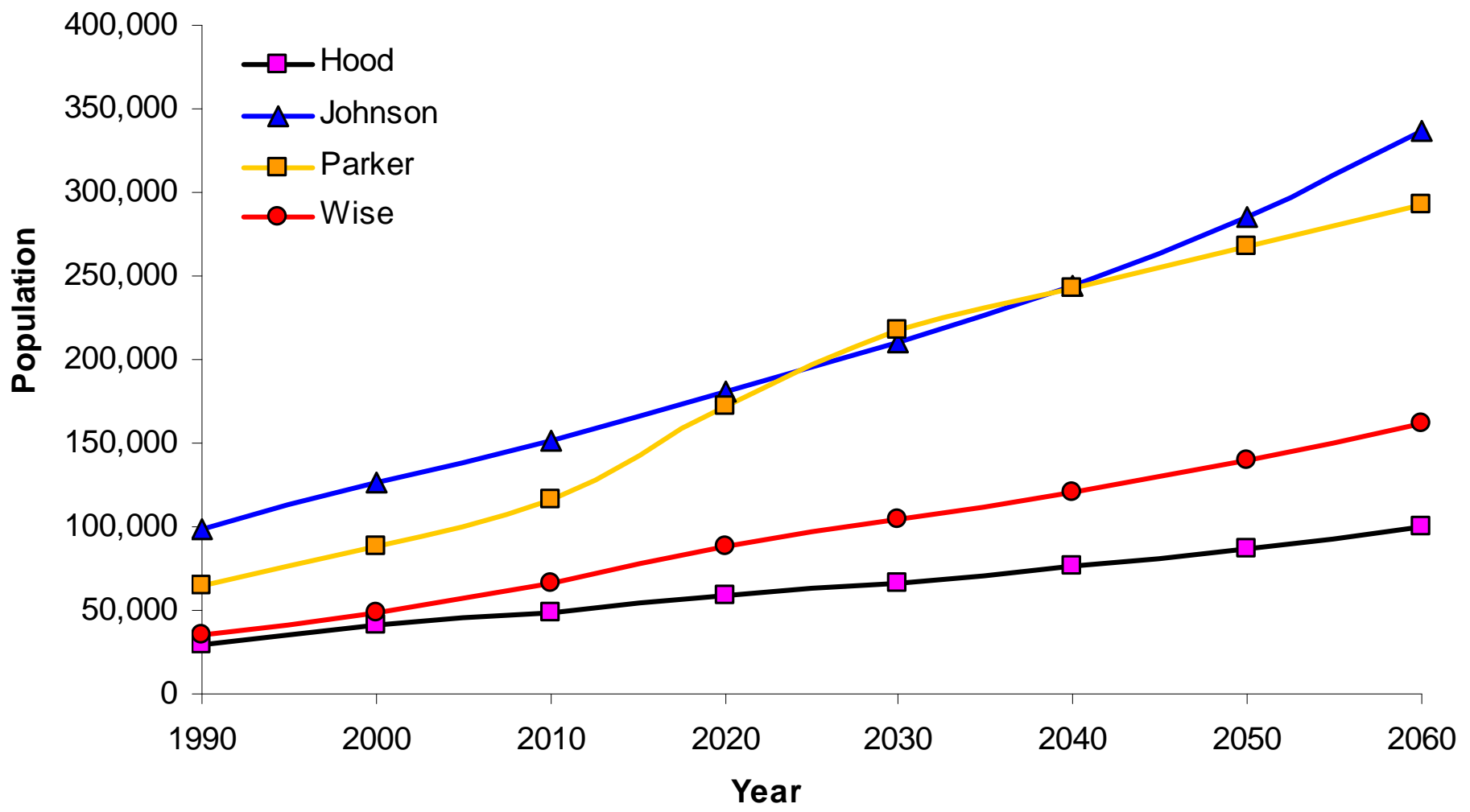


/// Bamet Shale use area
/// Updated rural domestic and municipal use area

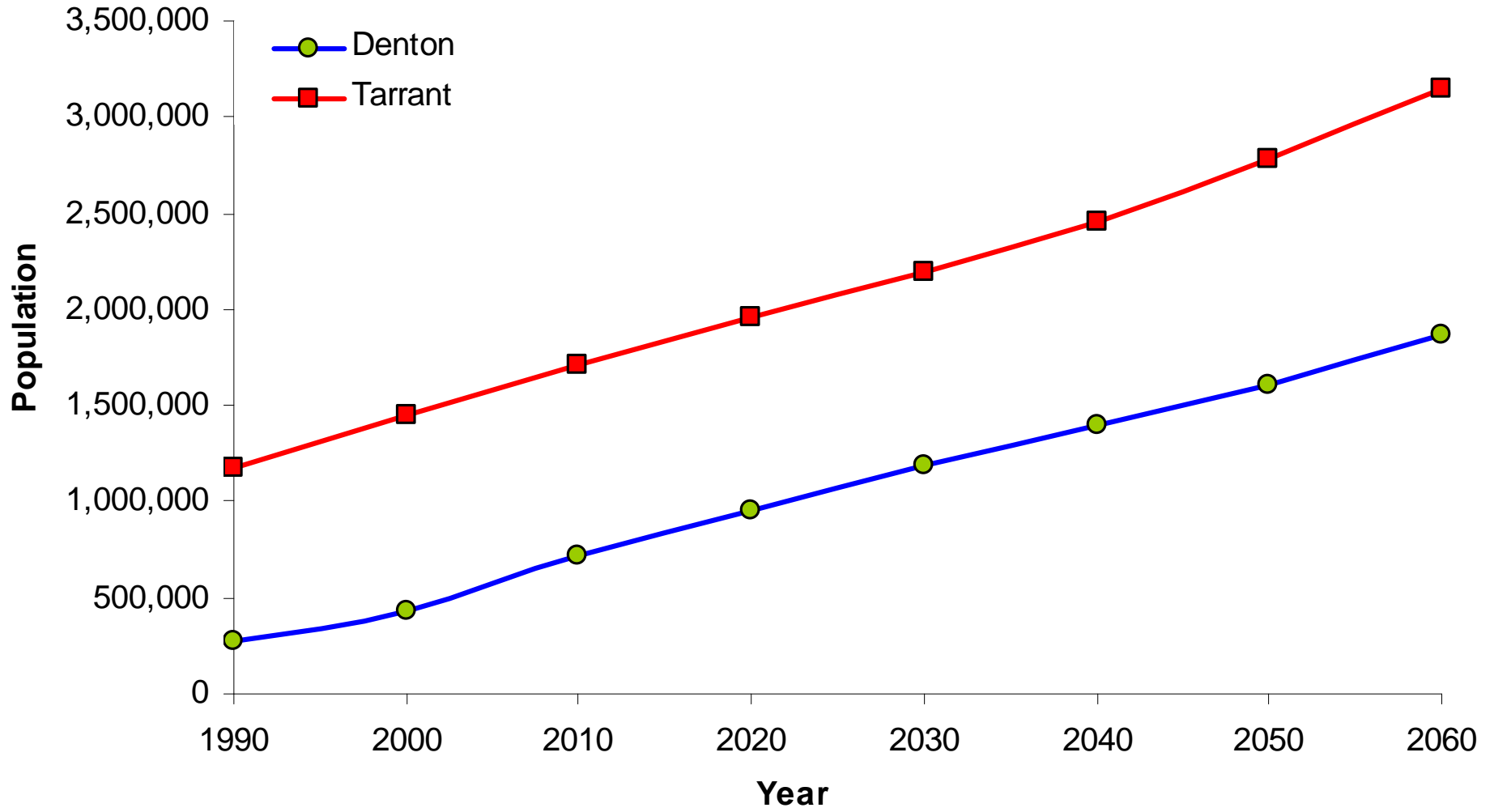
Trinity aquifer
Outcrop
Subsurface

Woodbine aquifer
Outcrop
Subsurface

Historical and Future Population Trend

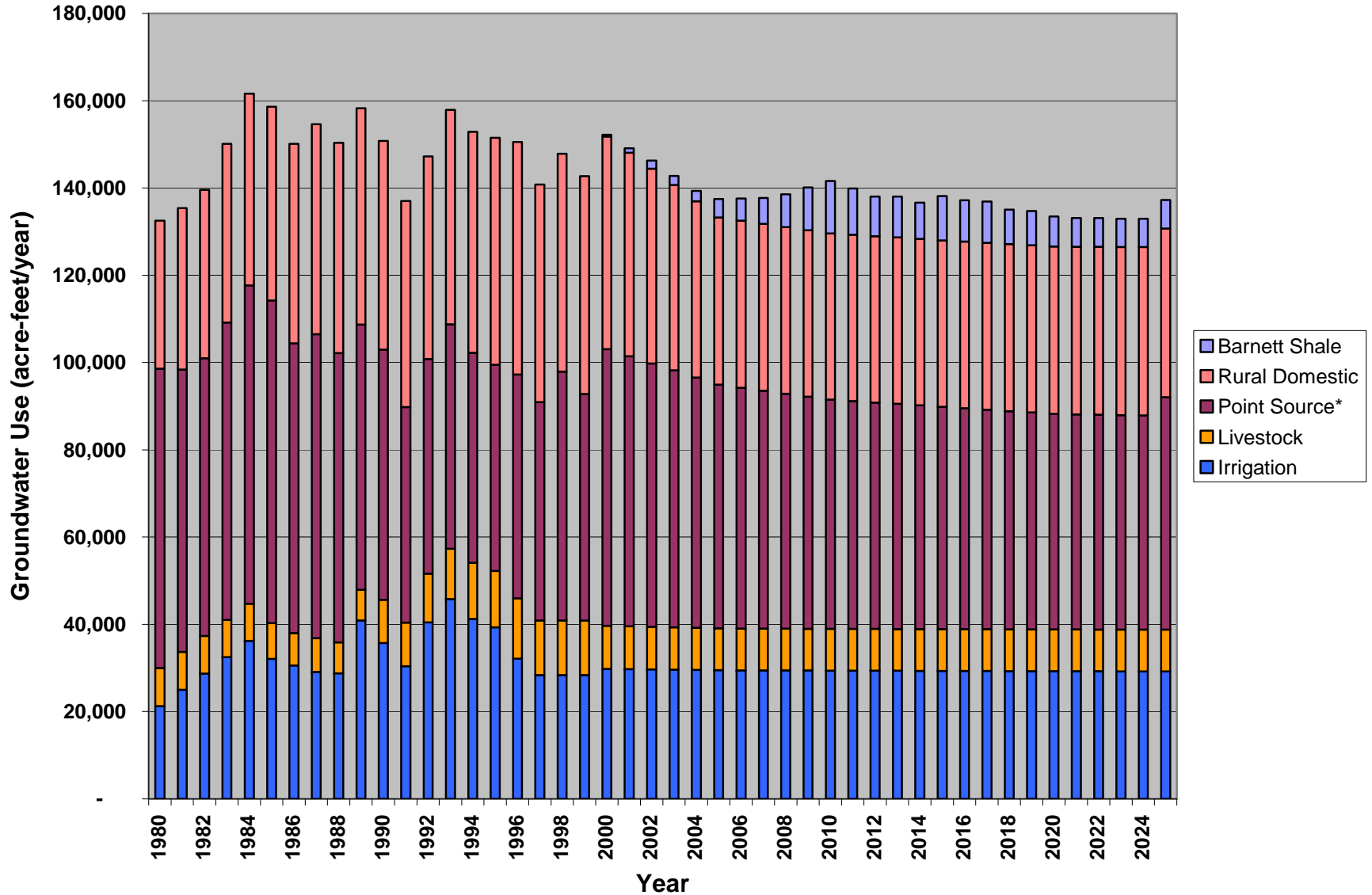


Historical and Future Population Trend



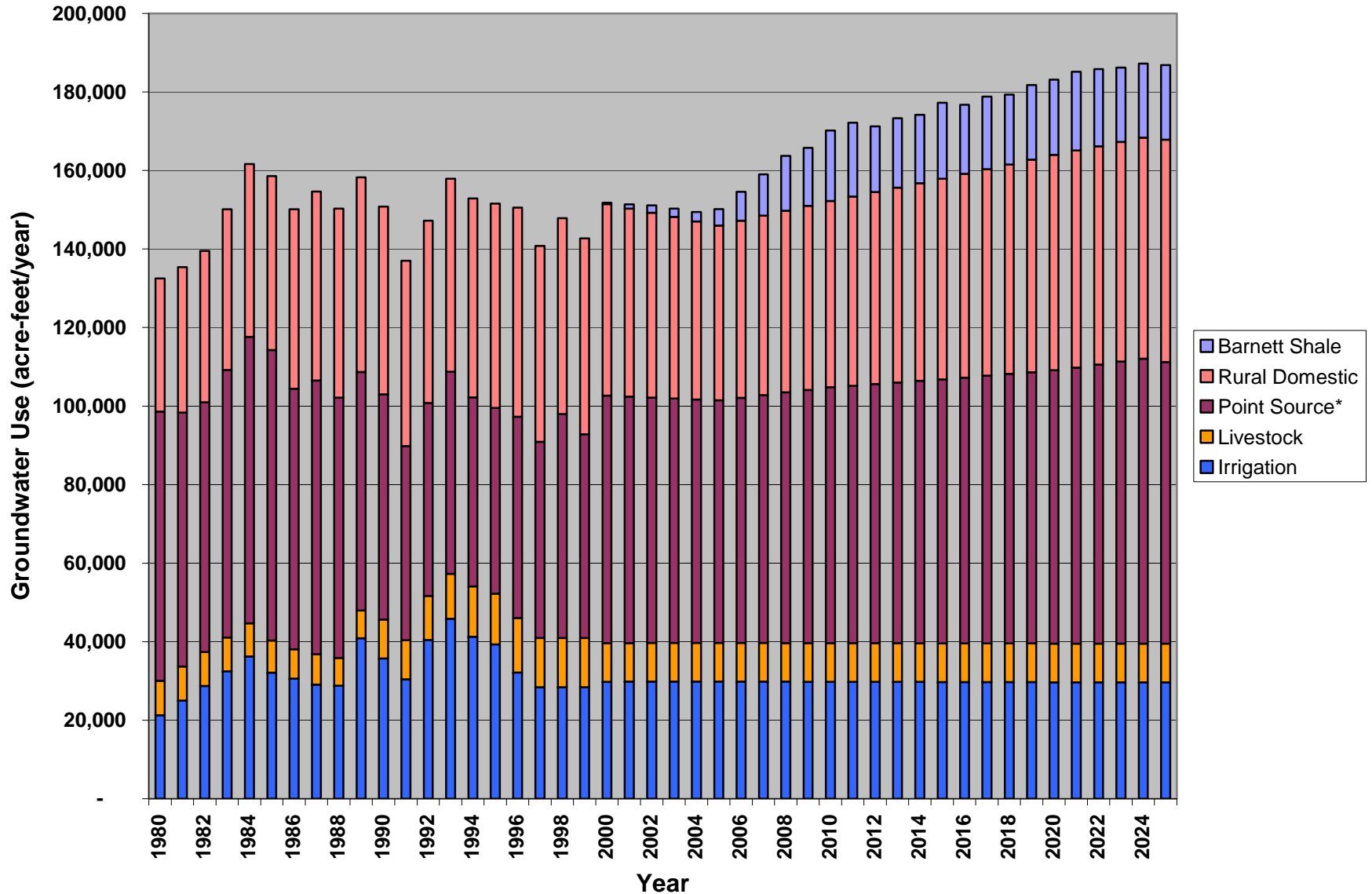
Total groundwater use

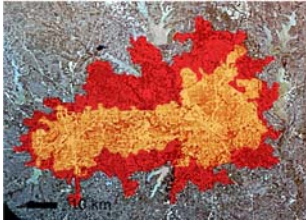
Low use estimate



Total groundwater use

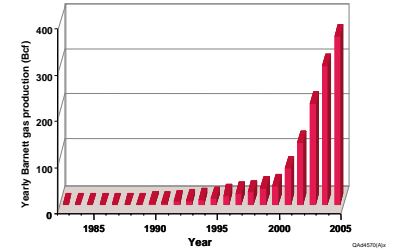
High use estimate



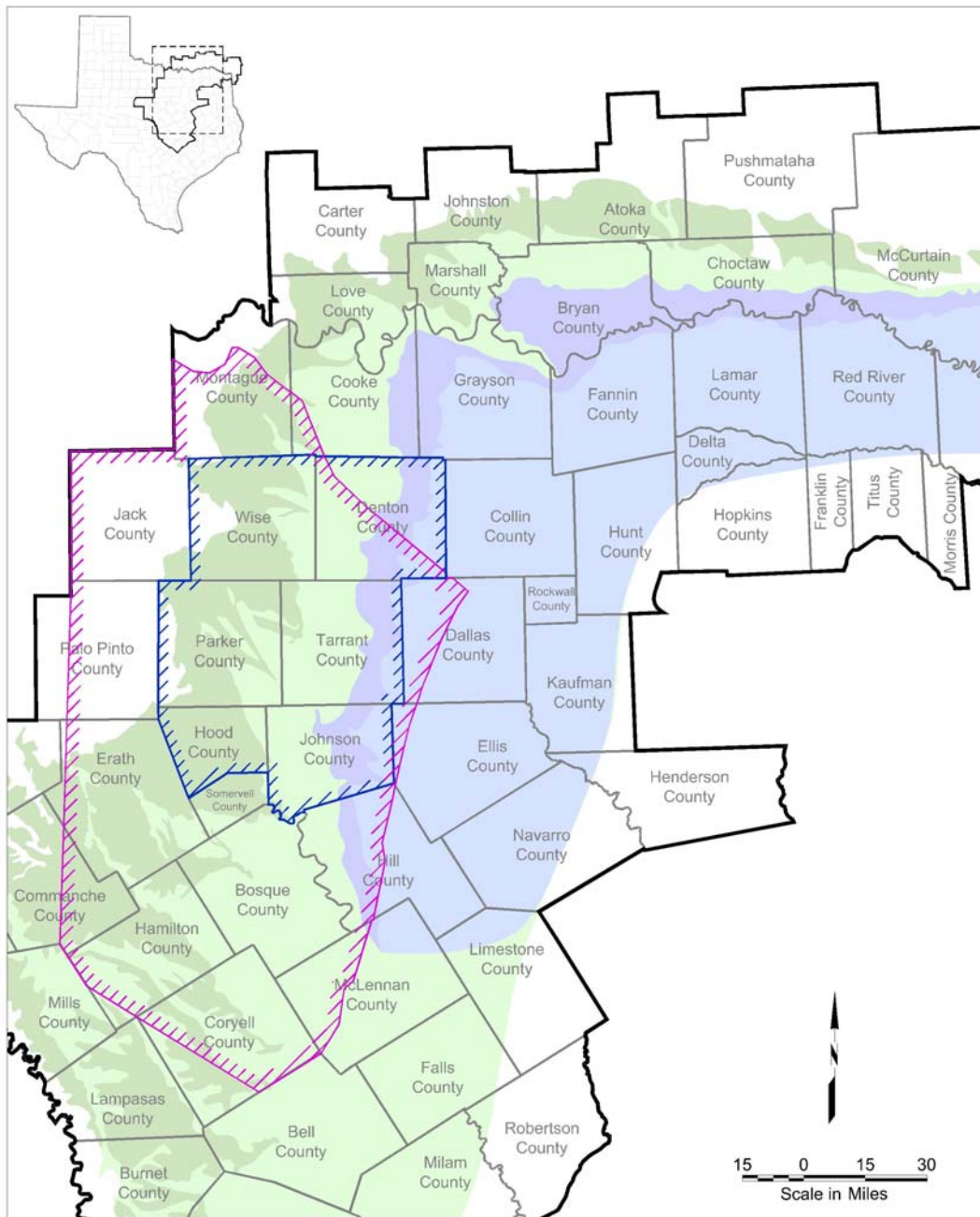


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Study Area

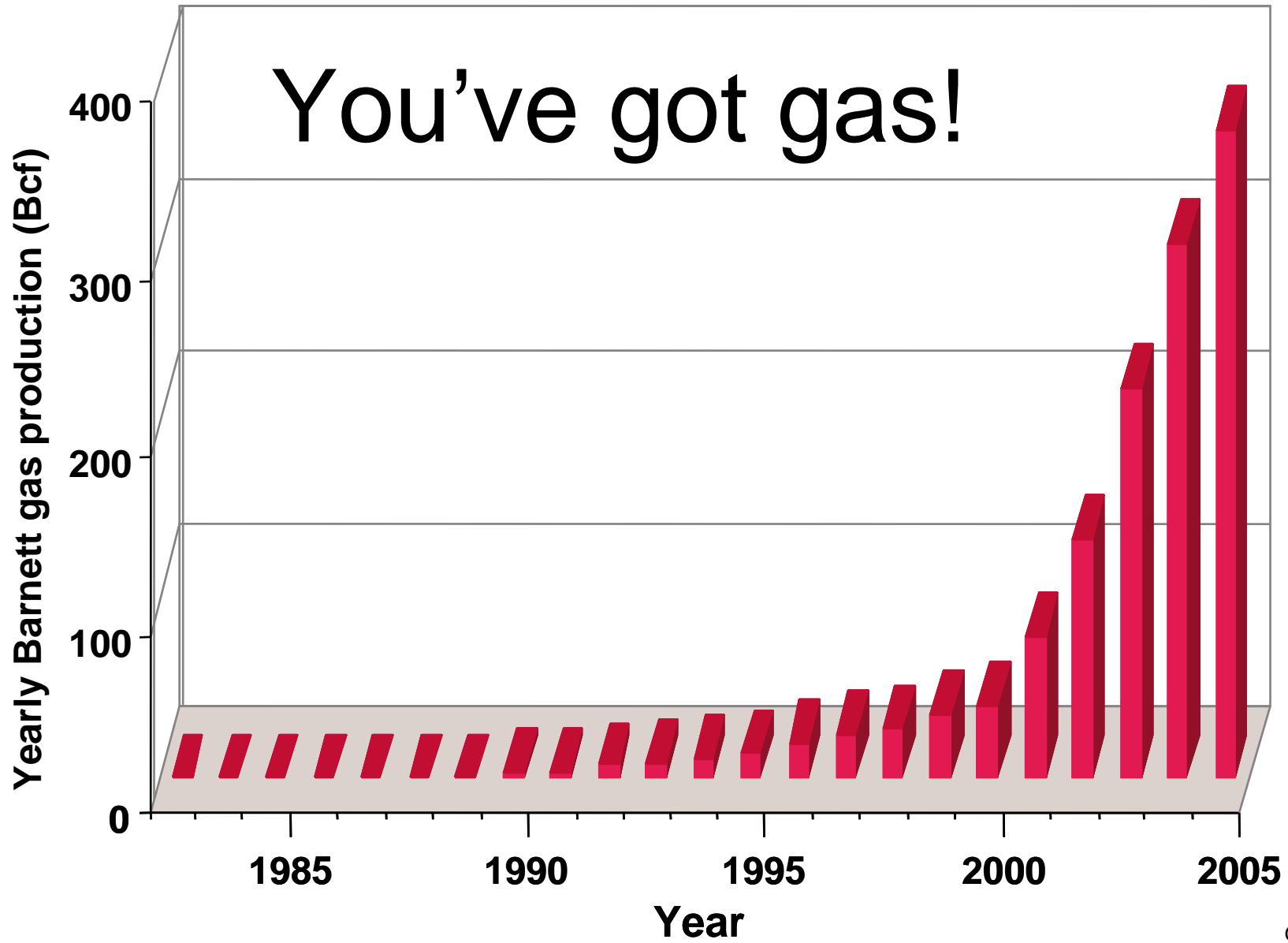


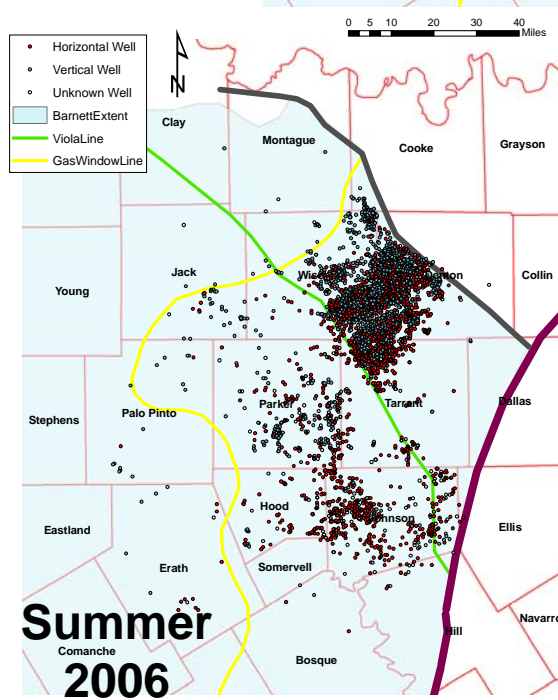
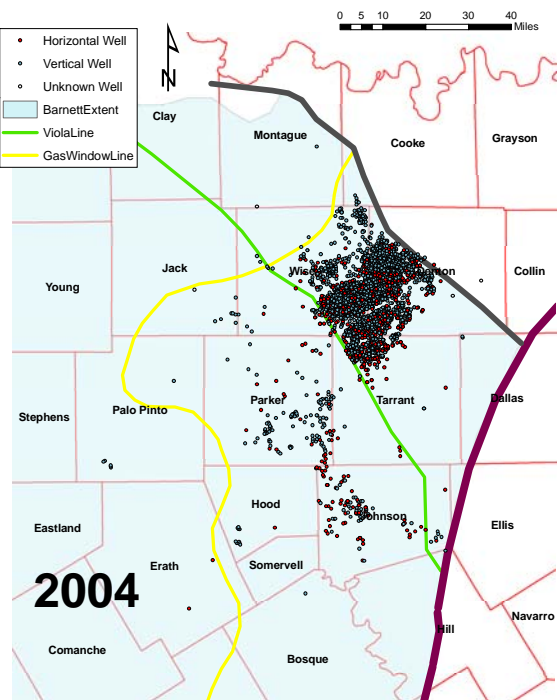
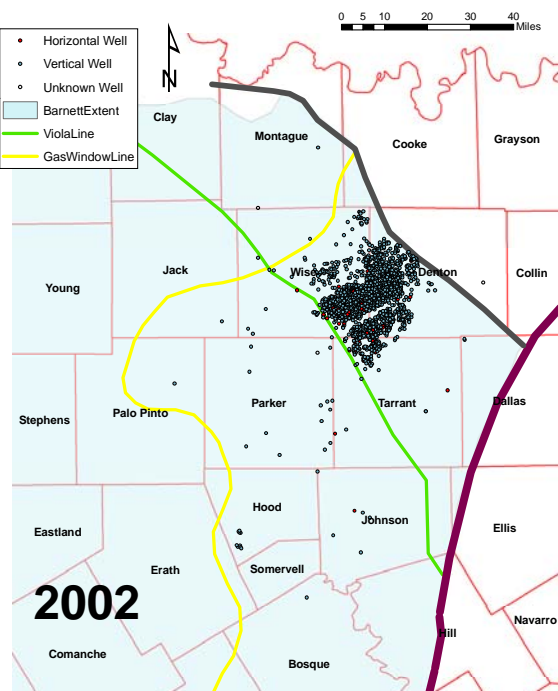
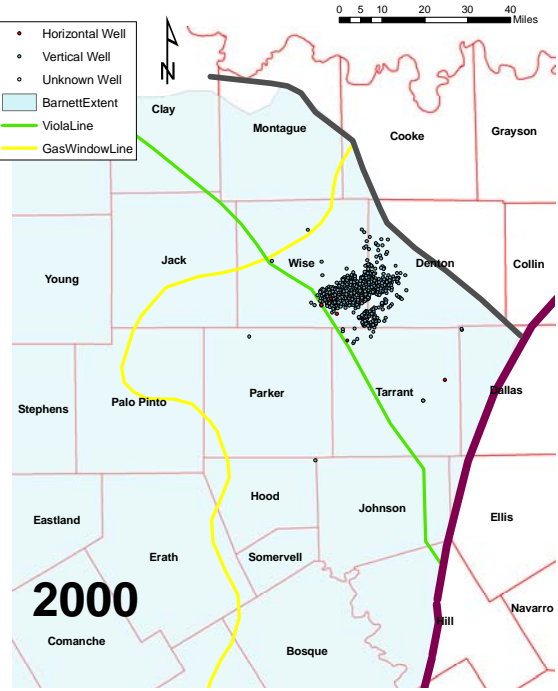
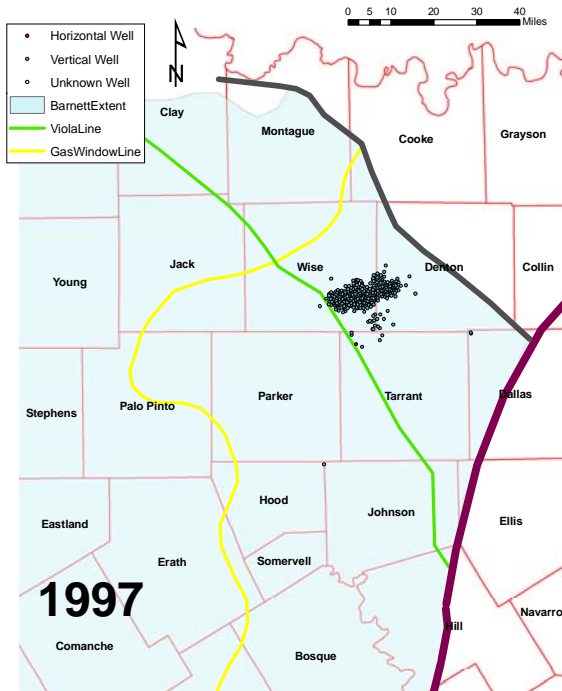
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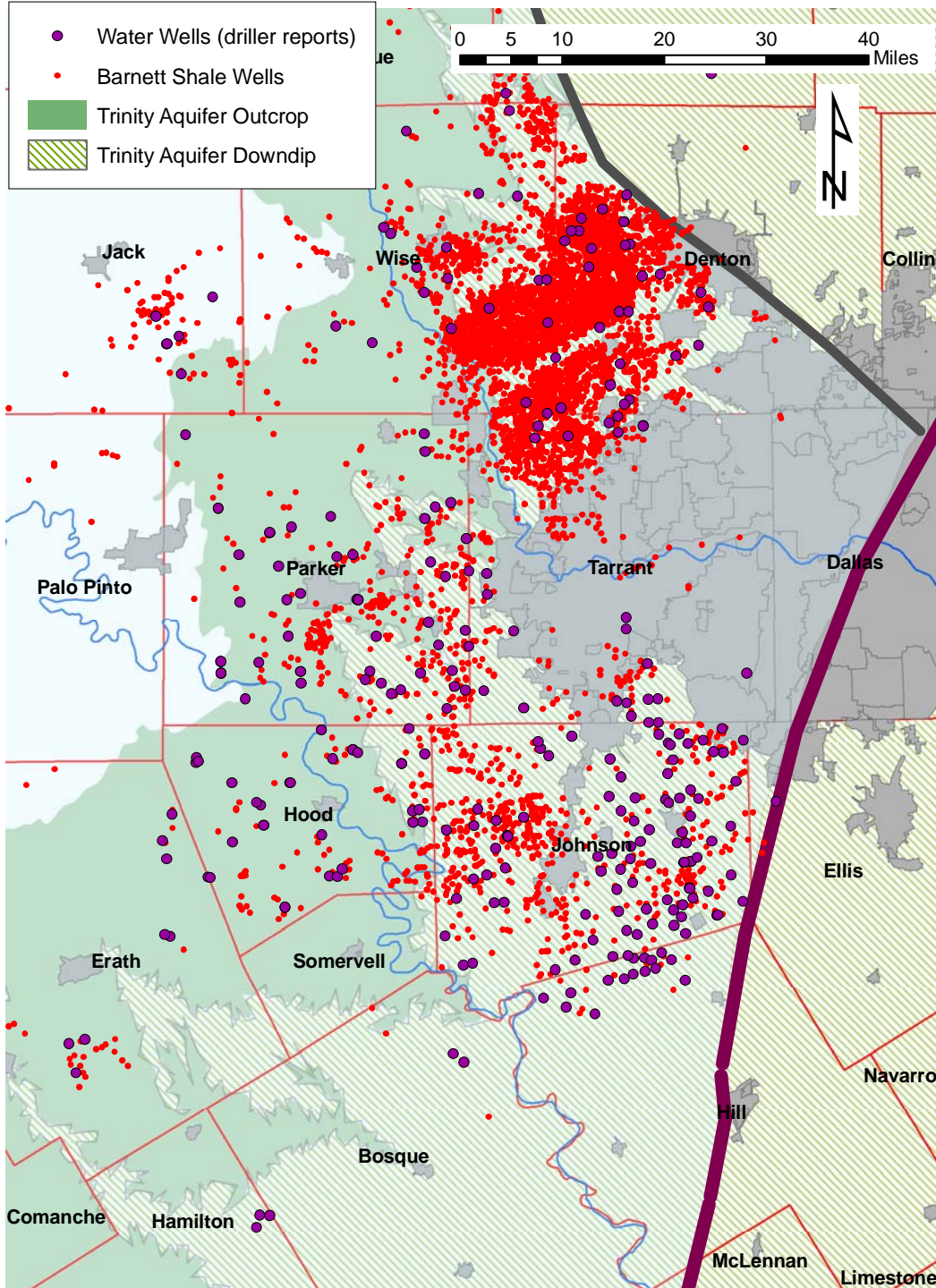
Trinity aquifer
Outcrop
Subsurface

Woodbine aquifer
Outcrop
Subsurface

You've got gas!







Water wells for Barnett Shale

(not complete...)

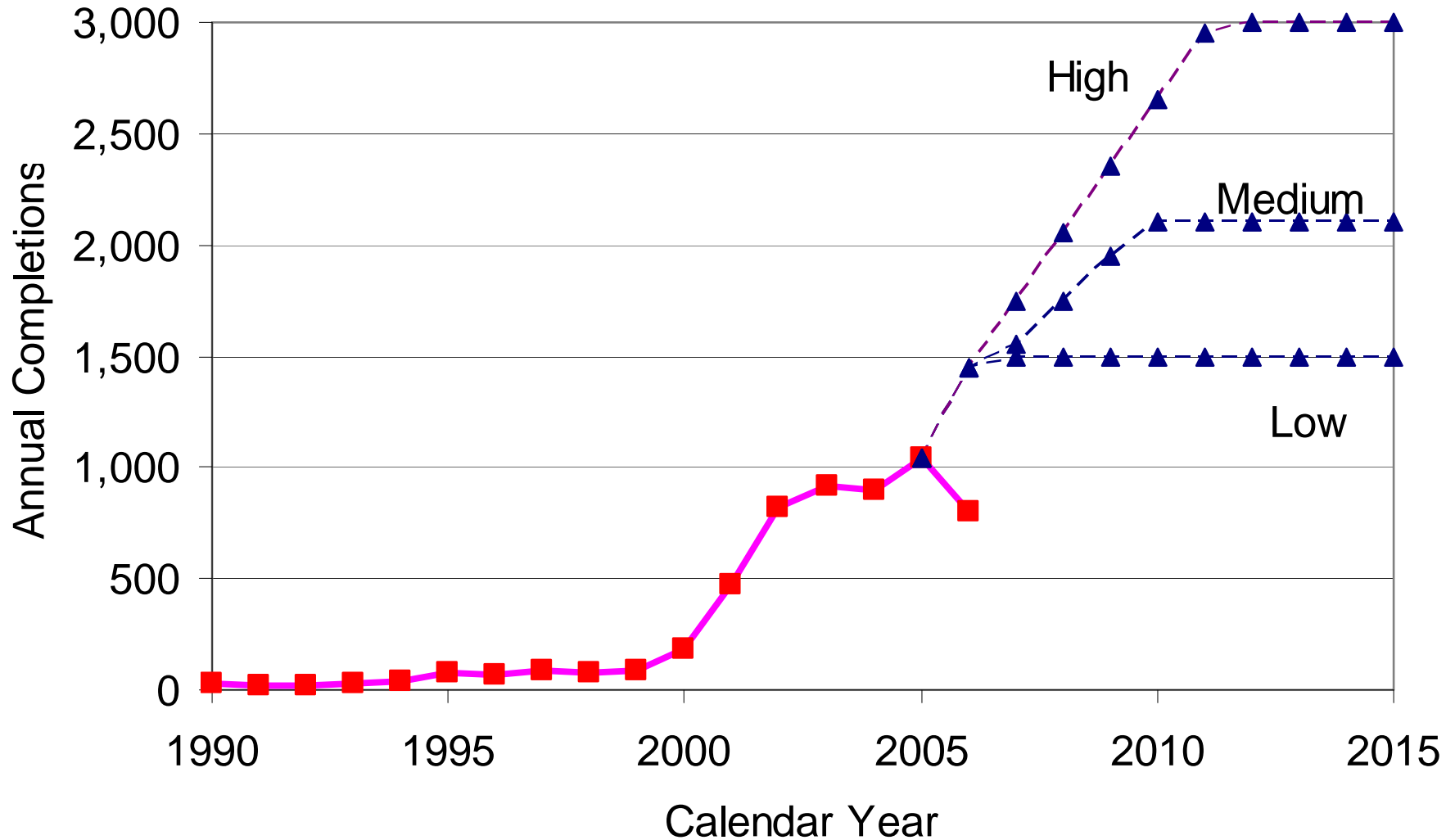


Some Barnett Shale water facts:

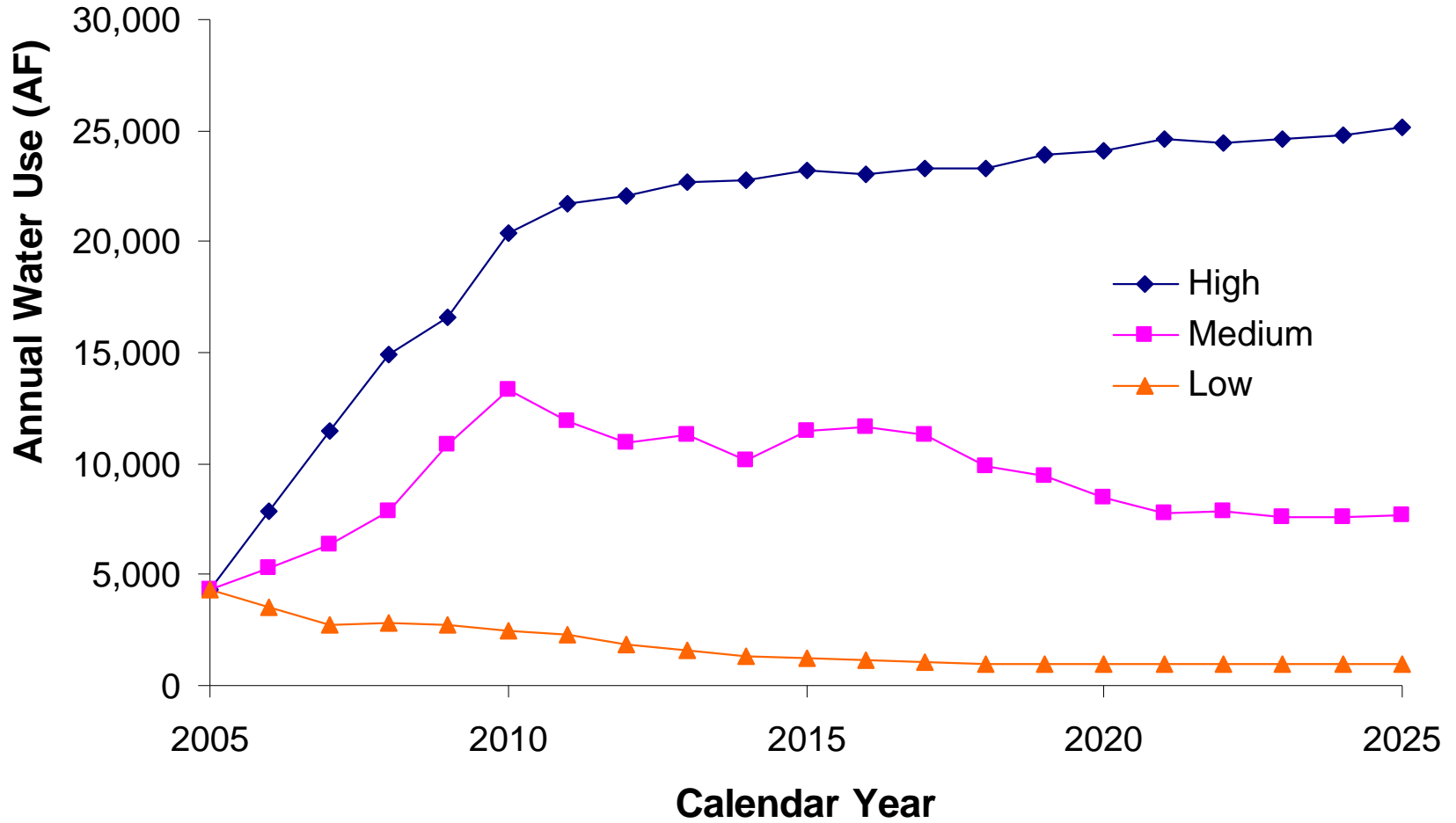
- 1.2 to 3.5 million gallons per frac (4 to 11 acre-feet)
- Total water demand for Barnett Shale was about 7,200 acre-feet in 2005
- <1% of total water use
- About 60% (4,300 acre-feet) from groundwater
- ~3% of total groundwater use

The past and 3 futures

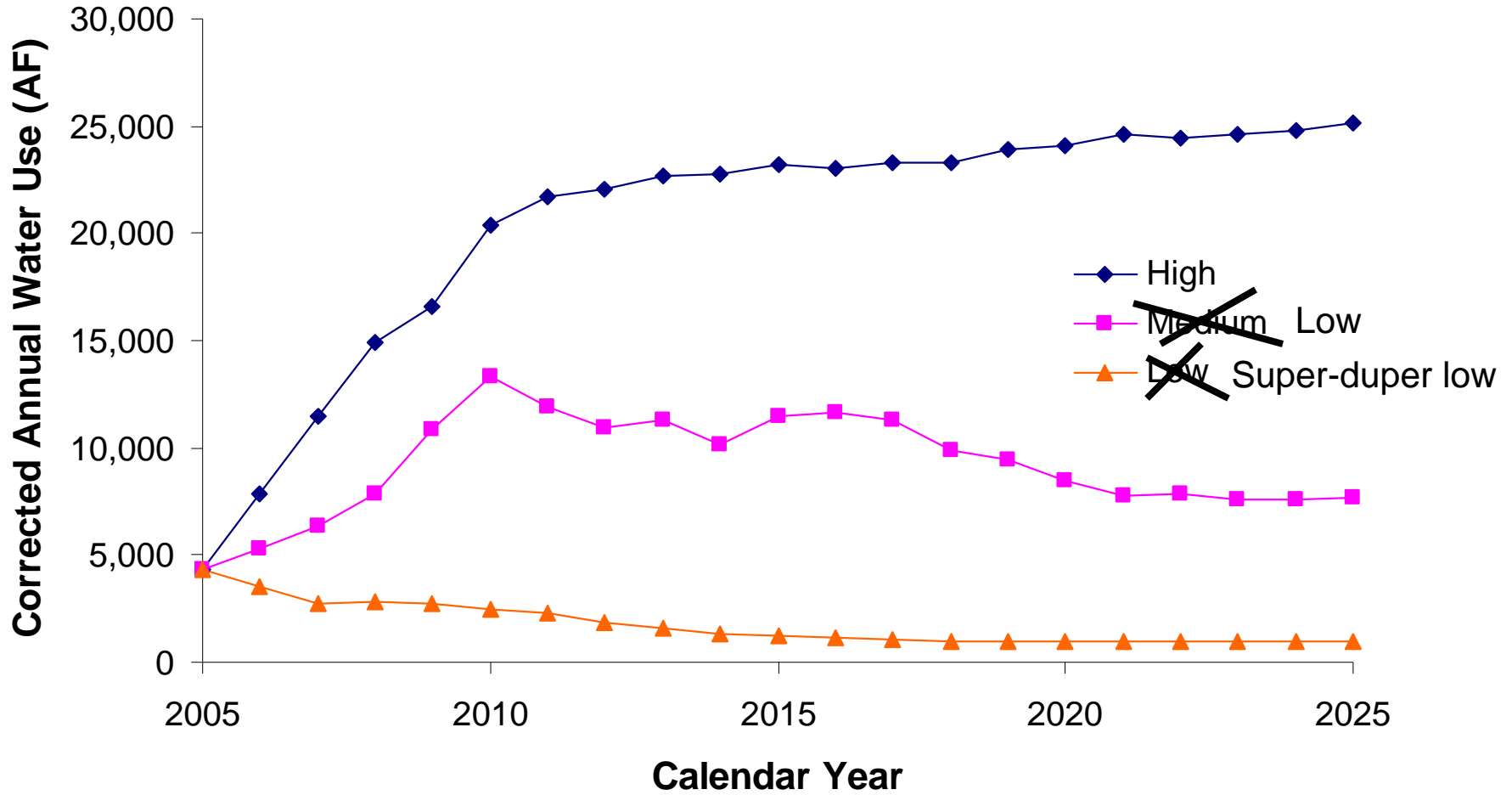
gas wells



Groundwater use for Barnett Shale

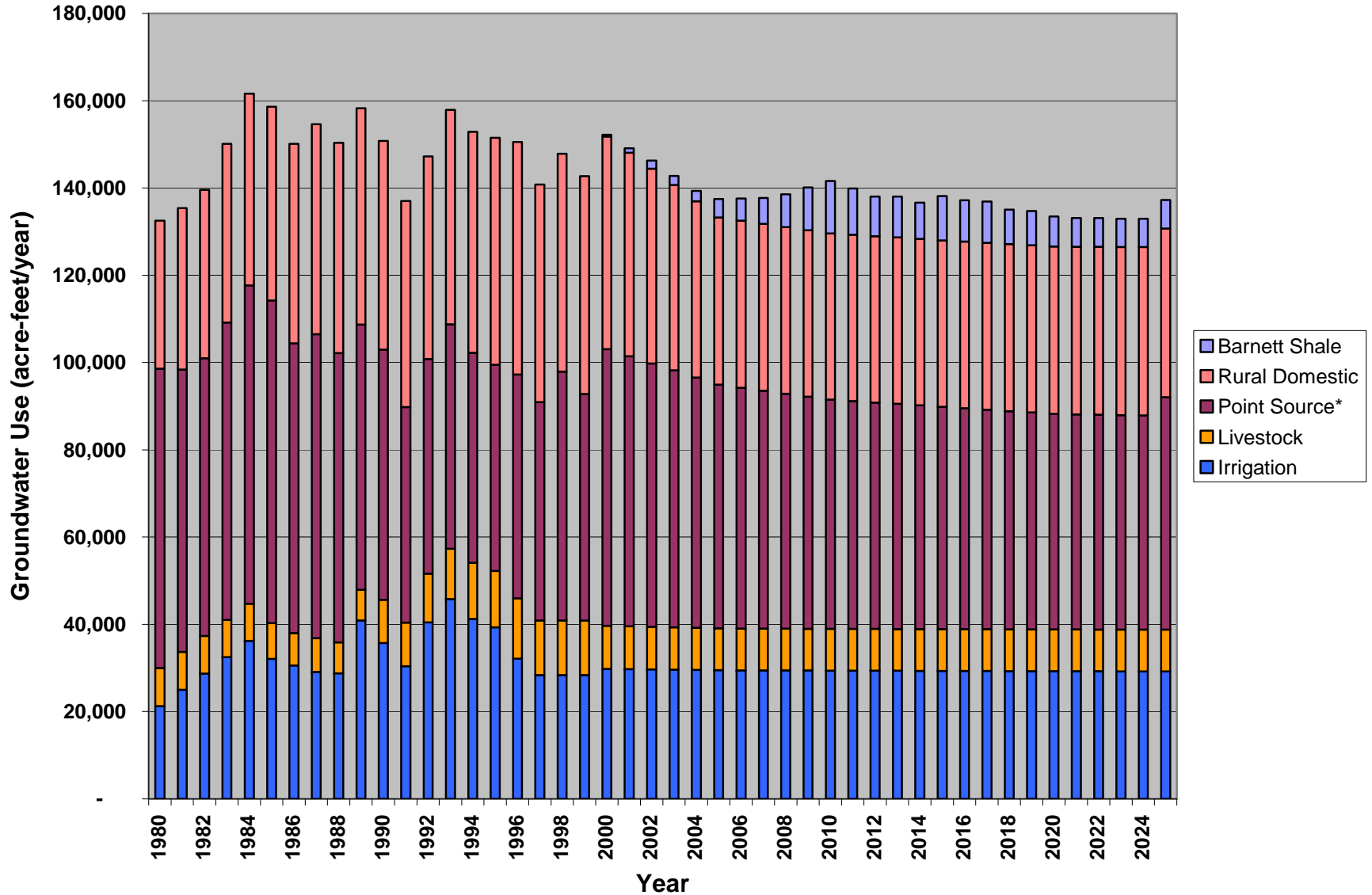


Groundwater use for Barnett Shale



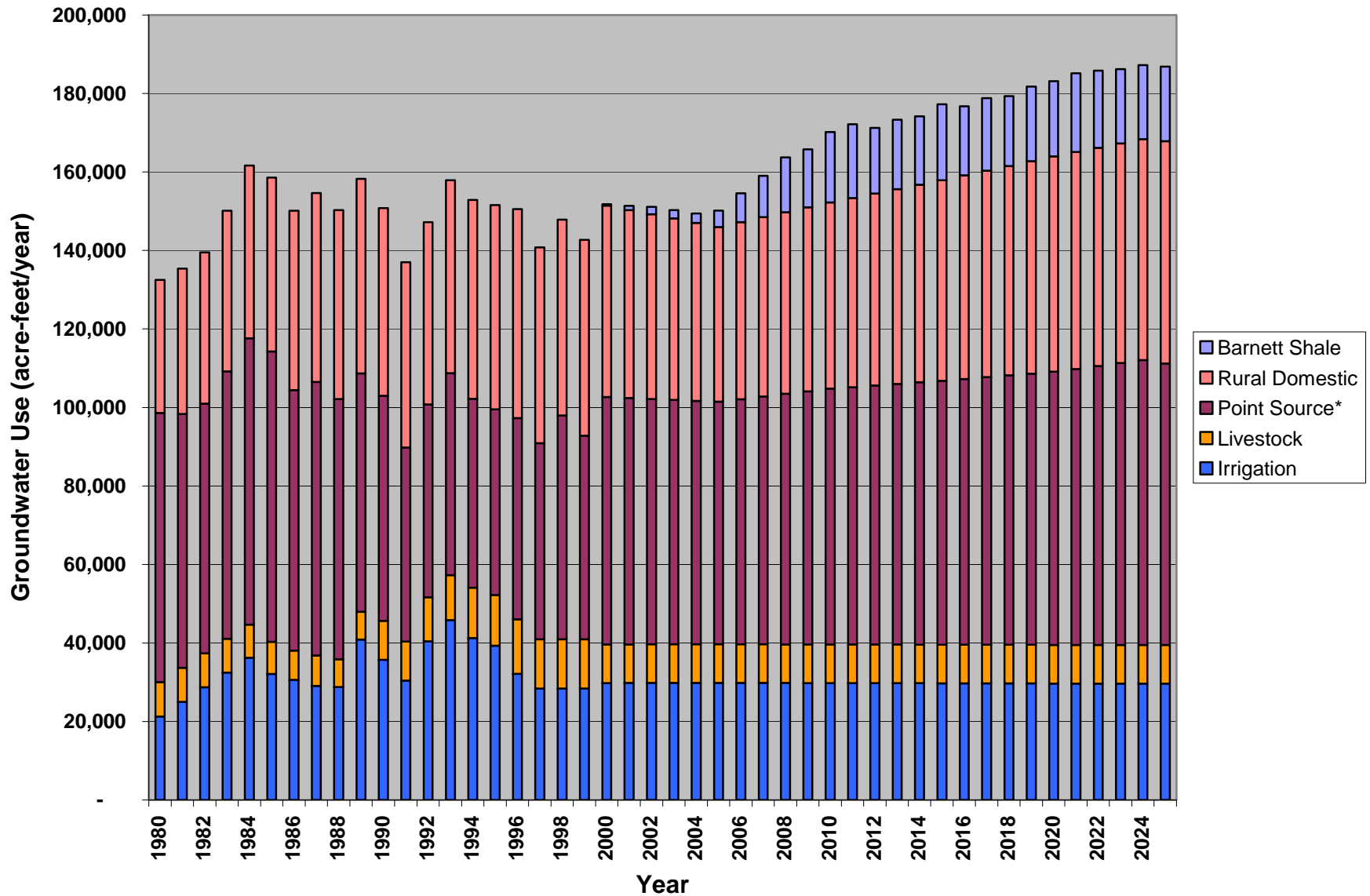
Total groundwater use

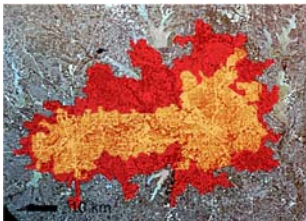
Low use estimate



Total groundwater use

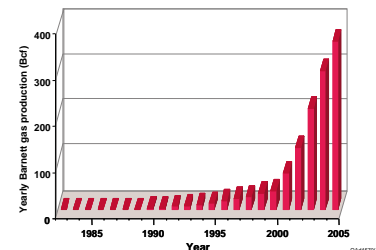
High use estimate





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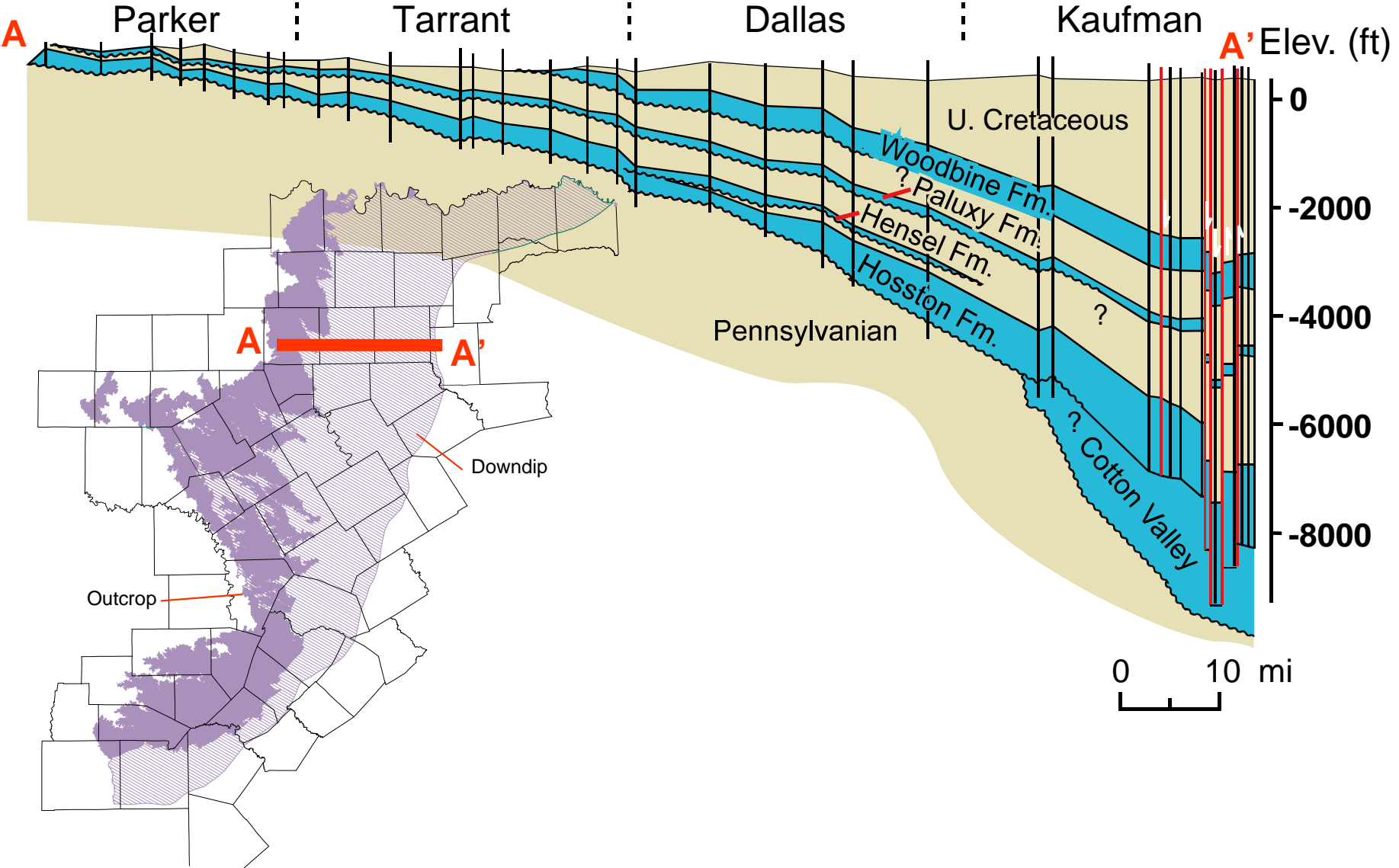


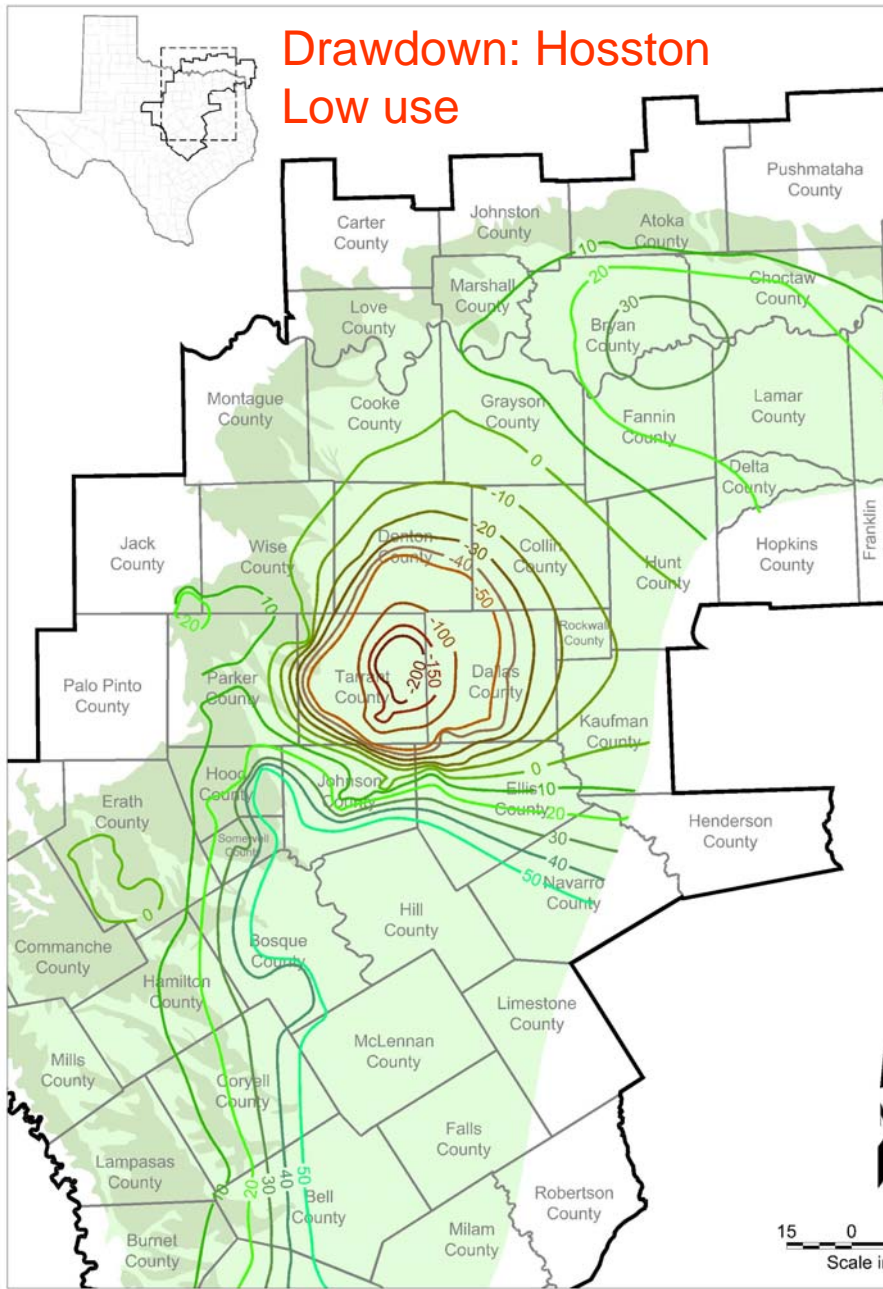
STRUCTURE CROSS SECTION

Cretaceous Siliciclastic Aquifers

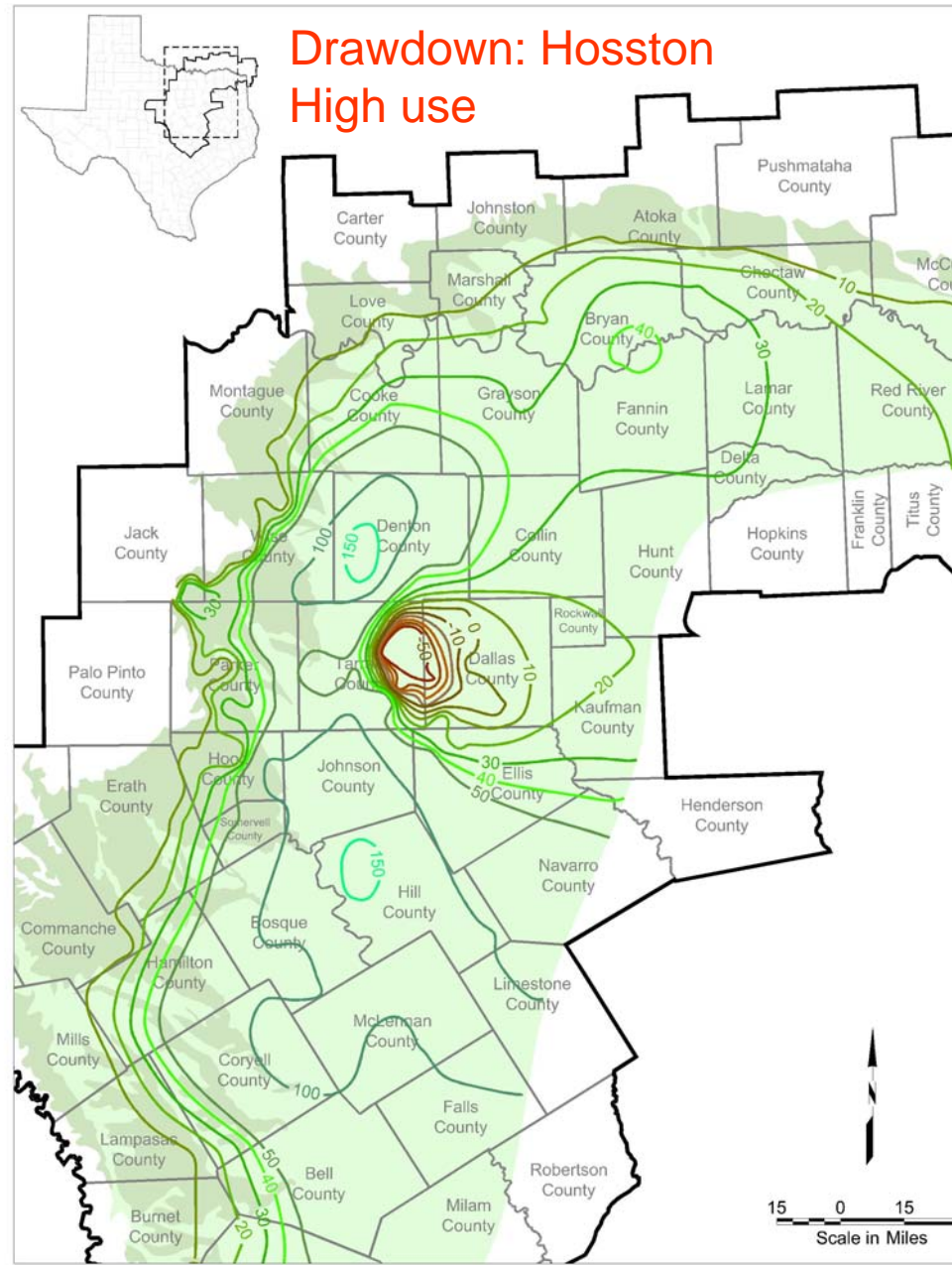
West

East





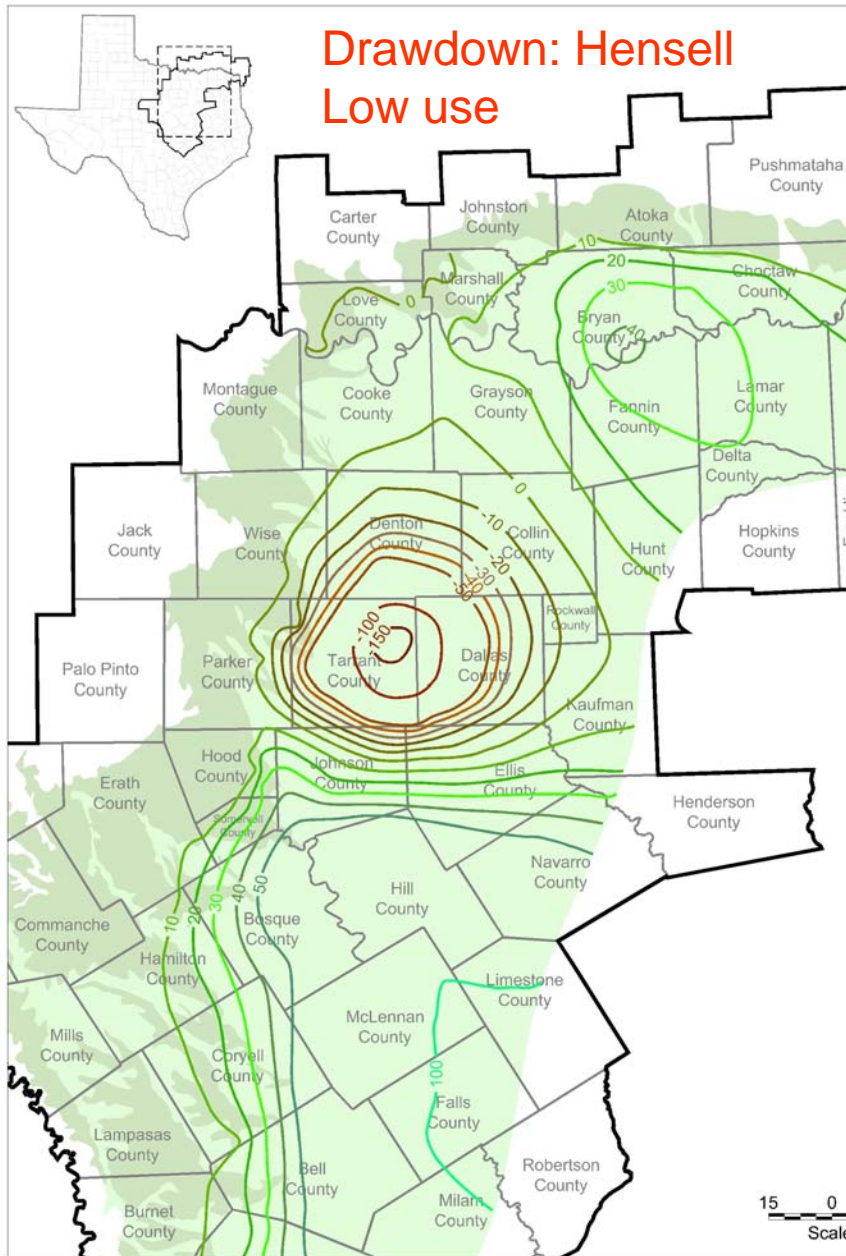
— 100 — Contour showing simulated drawdown or recovery in Hosston from 2000 - 2025, feet (negative (-) values indicate recovery) Interval varies



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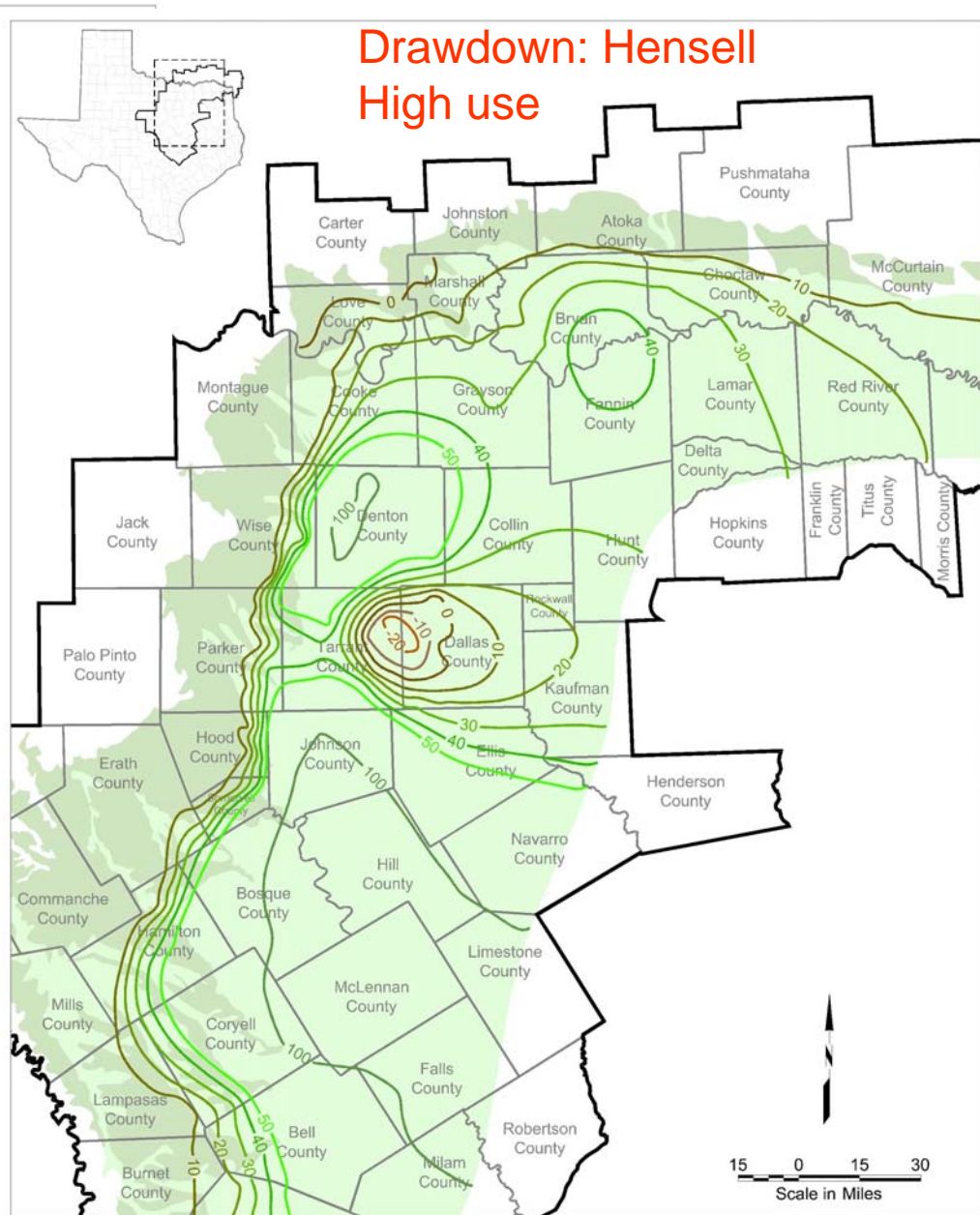
15 0 15
Scale in Miles

Drawdown: Hensell Low use





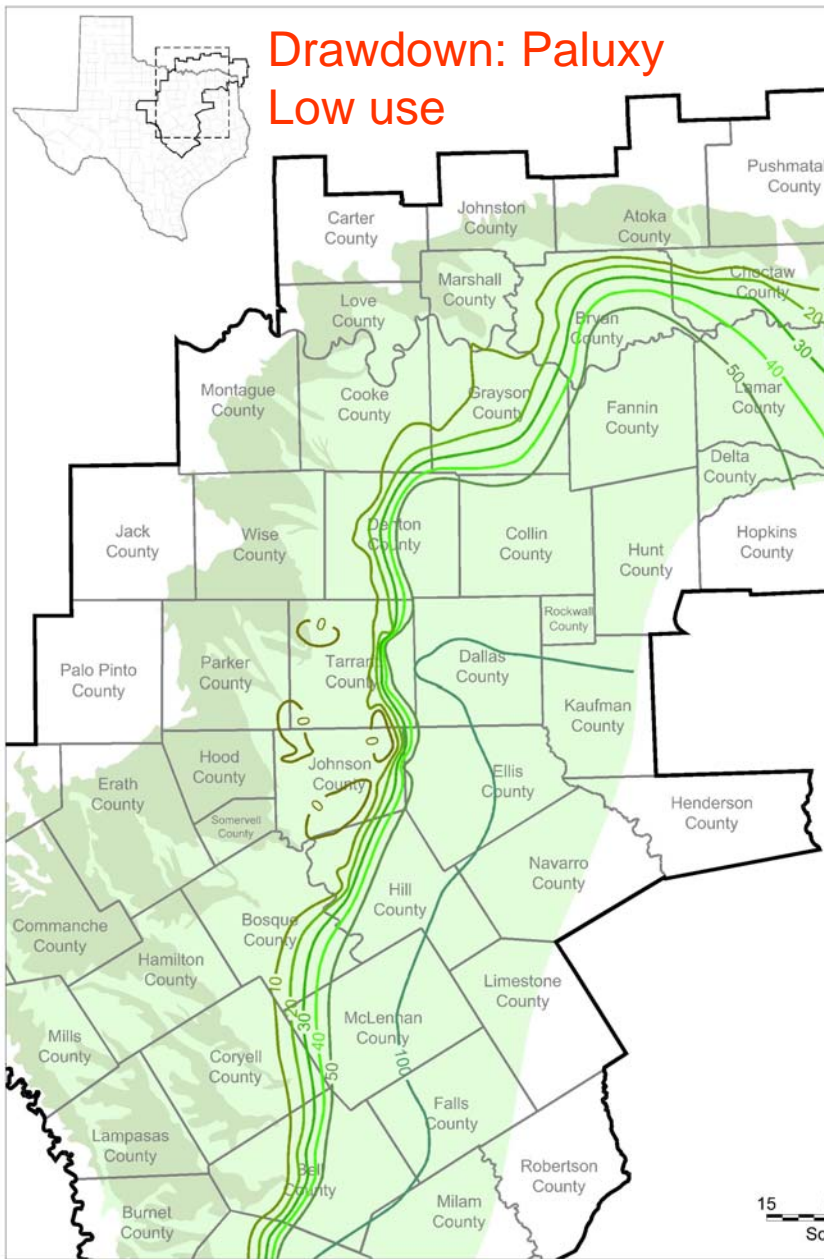
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Drawdown: Hensell High use

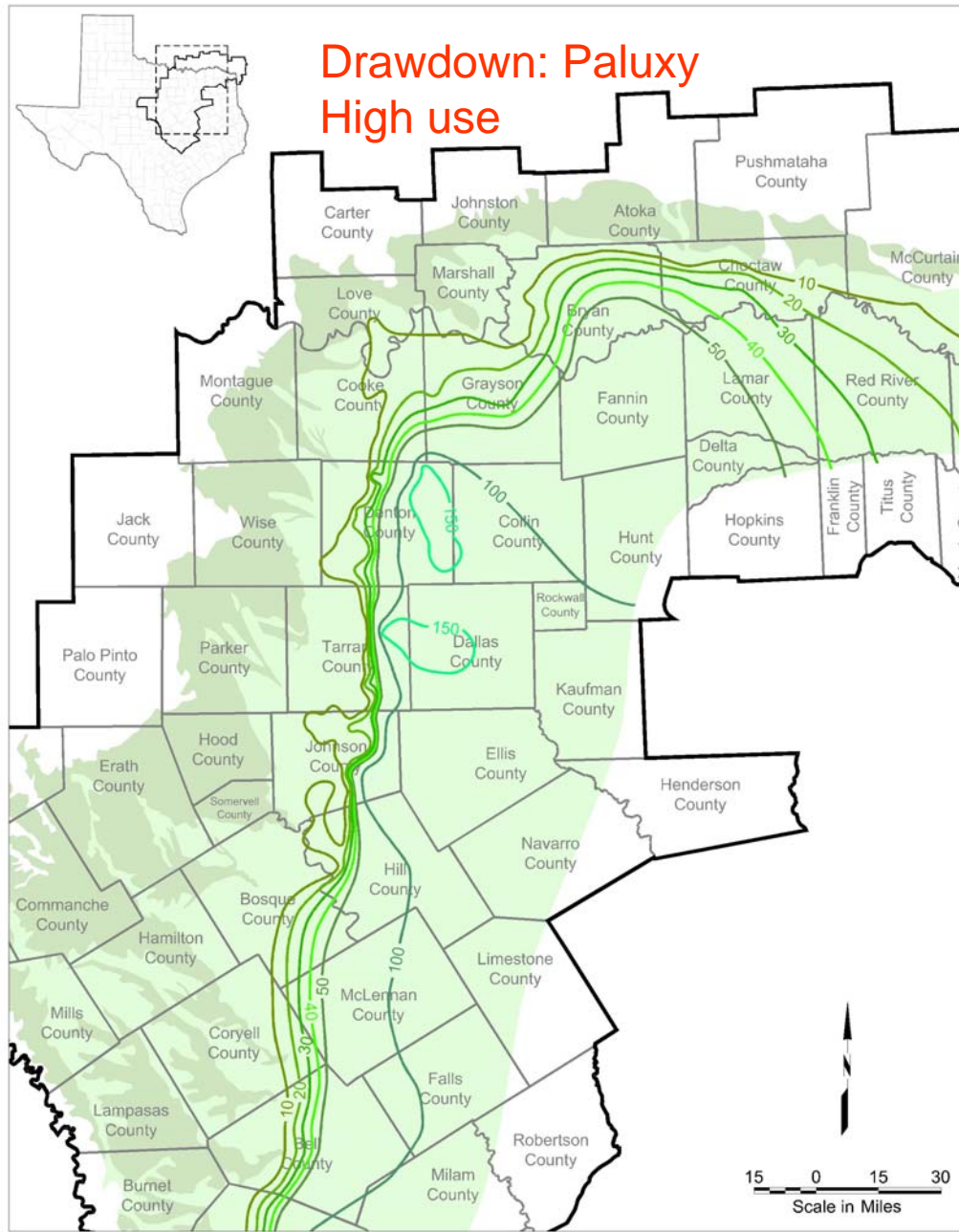


— 100 — Contour showing simulated drawdown or recovery in Hensell from 2000 - 2025, feet (negative (-) values indicate recovery) Interval varies

Trinity aquifer
 Outcrop
 Subsurface



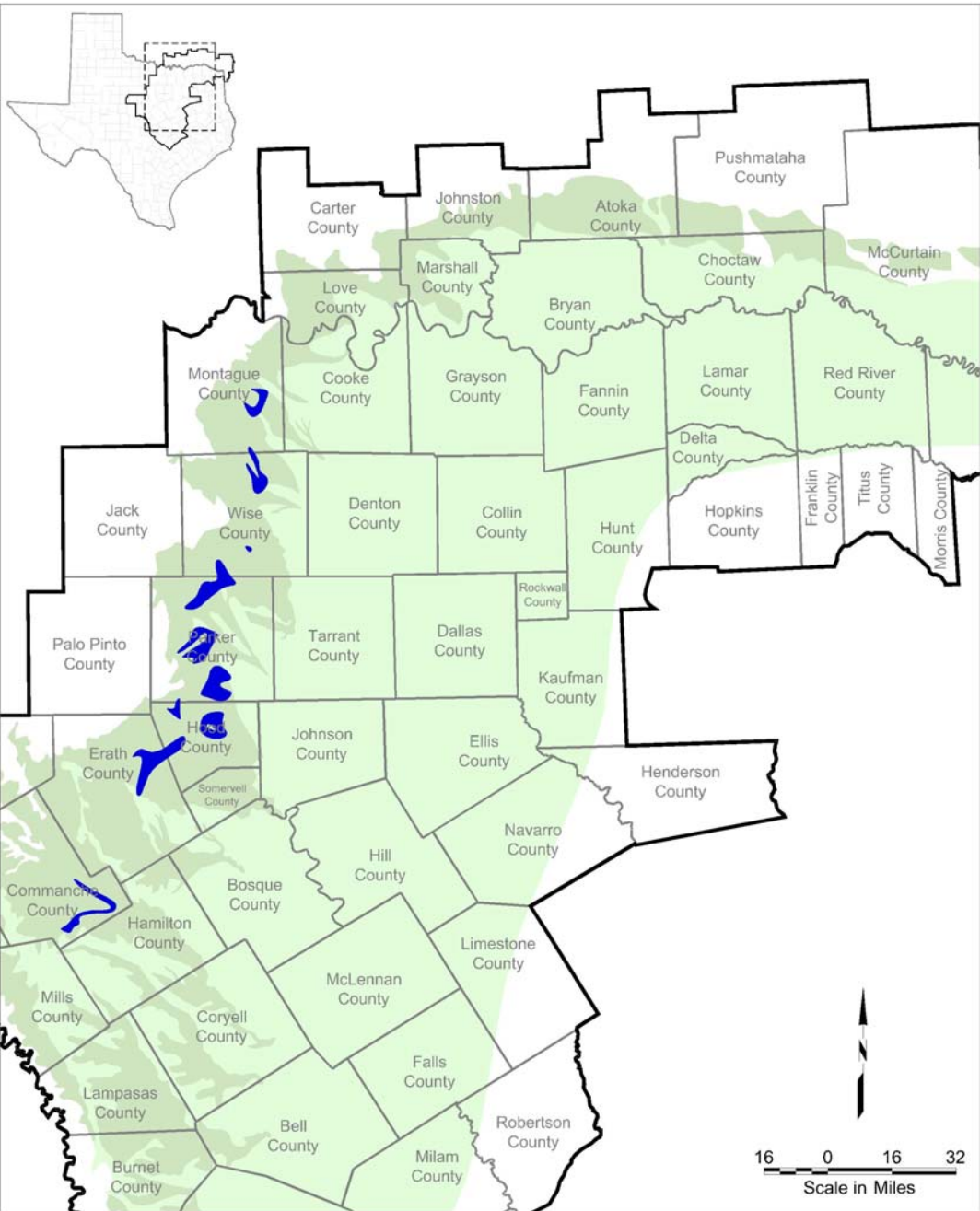
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Trinity
Outcrop
Subsur

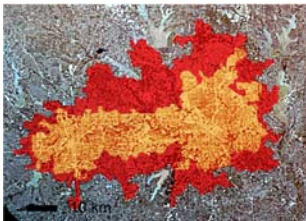
Simulated water table declines



 New Hosston water table areas

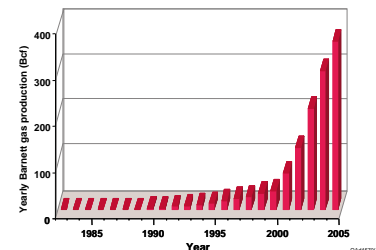
Trinity aquifer
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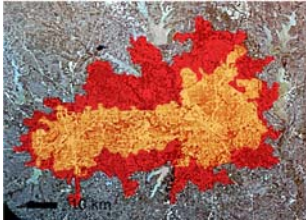
16 0 16 32
Scale in Miles



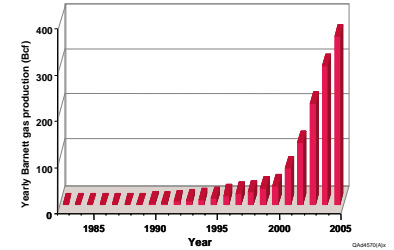
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Conclusions



- Lots of water being used in North Texas
- Lots more water going to be needed in North Texas
- Large historic groundwater level declines
- Future groundwater use may remain the same (~140,000 acre-feet per year) or increase (~190,000 acre-feet per year)
- Water levels will decline if pumping increases

More about groundwater in Texas



Groundwater in Texas:

www.twdb.state.tx.us/groundwater

- **Robert Mace:**

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